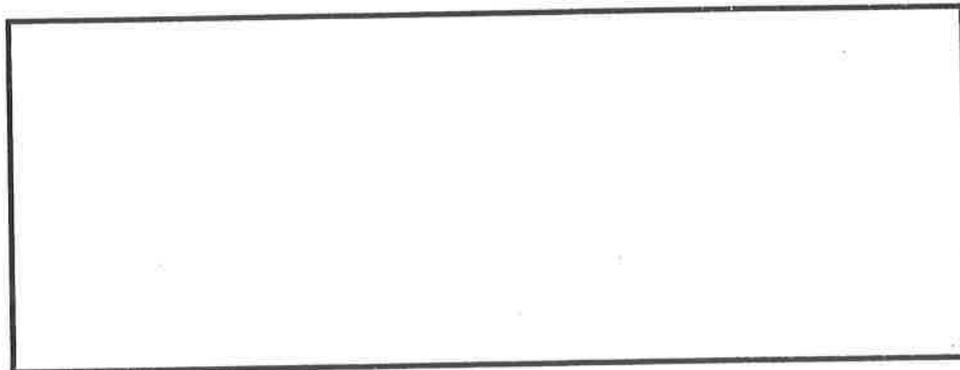


**MT. STERLING**  
**WATER & SEWER**  
**SYSTEM**

**SPECIFICATIONS**

**FOR**

**WATER SYSTEM AND SEWER SYSTEM DESIGN,  
CONSTRUCTION, AND INSPECTION**



**MT. STERLING WATER & SEWER SYSTEM**  
**300 East Main Street, P. O. Box 392**  
**Mt. Sterling, Kentucky 40353-0392**

**APRIL, 1999**

SECTION FOUR

# SANITARY SEWERS

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**4.0 PURPOSE** - The purpose of this section is to outline the requirements for proper design, construction, inspection, and final acceptance of manholes, sanitary sewer lines and house connections.

**4.1 DESIGN REQUIREMENTS** - A complete set of computations should be made available to the UTILITY in a tabular form, which indicates depth of flow and velocities at minimum, average, and maximum daily waste flows for the different sizes of sewers proposed.

**4.1.1 Depth** - In general, sewers shall be sufficiently deep so as to receive sewage from the first floor of all places served by the sewers and to prevent freezing, but shall not be less than 3 feet deep.

**4.1.2 Slope** - All sewers shall be so designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second. The following are the minimum slopes which should be provided; however, slopes greater than these are desirable.

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100 Feet</u>
8 inch	0.40
10 inch	0.28
12 inch	0.22
14 inch	0.17
15 inch	0.15
16 inch	0.14
18 inch	0.12
21 inch	0.10
24 inch	0.08
27 inch	0.067
30 inch	0.058
36 inch	0.046

Sewers shall be laid with uniform slope between manholes. Sewers on 20 percent slope or greater or when specified by the UTILITY, shall be anchored with concrete anchors spaced one per joint of pipe.

**4.1.3 Sizing** - New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable. Generally, the main, trunk and outfall sewers shall be designed to carry, when running full, not less than 250 gallons daily per capita contributions of sewage, exclusive of sewage or other waste flow from industrial plants.

**4.1.4 House Connections** - Each single family residence or single owner duplex shall have a single service connection. Multiple unit townhouses shall have a separate service line to the public sewers for each unit. Multiple unit apartment buildings and condominium buildings may have a single service line from each separate building.

**4.2 PIPE MATERIALS** - All pipe, joint, and fittings for sanitary sewer shall be constructed of polyvinyl chloride (PVC), or ductile iron pipe unless otherwise approved by the UTILITY.

**4.2.1 Polyvinyl Chloride Pipe and Fittings (PVC)** - PVC pipe shall be extruded from Type 1, Grade 1, polyvinyl chloride material designed as PVC 1120, meeting ASTM Specifications D 3034, Type PSM, and a standard dimension ratio of SDR 35. Under streets and drives, PVC pipe shall be SDR 26.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.

The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, burst pressures, flattening, extrusion quality, marking and all other requirements of the Commercial Standards CS 256-63 shall be conformed with in all respects.

Pipe shall be furnished in maximum 13.0 foot lengths. The pipe shall have a bell on one end. Male ends of pipe must be beveled on the outside. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of pipe installation.

Pipe must be delivered to job site by means which will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as closed to the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after delivery to the job site, it must be stored in shaded location and strung as needed.

4.2.2 Ductile Iron Pipe and Fittings - Ductile cast iron pipe shall conform to ANSI A21.51 and AWWA C151. All ductile cast iron pipe thickness shall be designed according to ANSI A21.50 and AWWA C150 requirements.

Ductile cast iron pipe and fittings shall receive the standard cement mortar lining with bituminous seal coat on the inside in accordance with ANSI A21.4 requirements. Thickness of the lining shall be as set out in aforesaid specification. Pipe and fittings shall have standard coal tar or asphalt based bituminous outside coating a minimum of 1 mil thick.

Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or word "DUCTILE." Shop inspection and testing shall be in accordance with the AWWA Specifications cited above and shall be certified by an independent laboratory.

Fittings for ductile cast iron pipe shall be mechanical joint Class 250 gray iron conforming to ANSI A21.10 and AWWA C153 for short body ductile iron fittings. Fittings shall be bituminous coated outside and shall receive the standard cement mortar lining with bituminous seal coat on the inside as specified hereinbefore.

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an 8 mil thick polyethylene encasement meeting the requirements of ANSI A1.5. Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation, and waste dumps. If such corrosive soils are expected, the design engineer shall be responsible for conducting resistivity tests on the soil.

4.2.3 Steel Encasement Pipe - Encasement pipe shall be steel, plain end, uncoated, unwrapped, have welded joints and be in at least 18-foot lengths. The steel pipe shall have a yield point strength of 35,000 psi. The wall thickness of the pipe shall be a minimum of 0.250 inches for highway crossings and 0.344 inches for railroad crossings.

The thickness and diameter of encasement pipe shall conform to requirements set forth by the Kentucky Department of Transportation, Bureau of Highways for highway crossings and American Railway Engineering Association for railroad crossings.

4.3 TRENCH EXCAVATION - Unless specifically directed otherwise by the UTILITY, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew, and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans, cut sheets or as specified by the UTILITY. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus 8 inches. Where rock is encountered, it shall be removed to a minimum depth of 4 inches below the pipe bells.

Unless specifically authorized by the UTILITY, trenches shall in no case be excavated or permitted to become wider than 2 feet 6 inches plus the nominal diameter of the pipe at the level or below the top of the pipe. If the trench does become wider than 2 feet 6 inches at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted granular fill up to the top of the pipe or providing pipe with additional crushing strength determined by the UTILITY after

taking into account the actual trench loads that may result and the strength of the pipe being used. The OWNER-DEVELOPER shall bear the cost of such special precautions as necessary.

All excavated materials shall be placed a minimum of 2 feet from the edge of the trench.

Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage to work.

Trenches shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of water shall be at the OWNER-DEVELOPER'S expense.

Backfilling shall be as set out hereinafter.

4.3.1 Obstruction - In cases where storm sewers, gas lines, water lines, telephone lines and other utilities, or other underground structures are encountered, they shall not be displaced or molested unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.

The CONTRACTOR shall notify the utility companies 48 hours prior to excavation adjacent to their facilities.

4.3.2 Shoring, Sheeting and Bracing of Excavations - Where unstable material is encountered or where the depth of excavation in earth exceeds 6 feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constructed areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the CONTRACTOR.

Foundations, adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the

excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the CONTRACTOR shall be held strictly responsible for any damage to said foundations.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable walers and braces.

Care shall be taken to avoid excessive backfill loads on the completed pipelines and the requirements that the width of the ditch at the level of the crown of the pipe be not more than 2 feet 6 inches plus the nominal diameter of the pipe shall, as set out in Section 4.3 hereinbefore, be strictly observed.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

4.3.3 Blasting - Shall be conducted in accordance with the municipal ordinances, state laws, and Section 9 of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, Inc. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within 5 feet of any water or sewer mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by him.

Blasting Operations shall be covered by public liability insurance, or if said public liability insurance does not cover blasting, then the CONTRACTOR shall have separate public liability insurance to cover his blasting operations.

Materials shall be on hand to repair any damage to nearby utility lines.

All blasting shall be supervised and performed by qualified personnel.

4.4 PIPE BEDDING - In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and

insofar as possible where bell and spigot pipe are involved so that none of the load will be carried on the bells.

Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least 4 inches above the bottom of the trench as excavated.

Supporting of pipe shall be as set out hereinafter, and in no case shall the supporting of pipe on blocks be permitted. See Drawing SD-1 for typical bedding methods.

4.4.1 Earth Foundation - All sewer pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be no. 9 crushed stone.

4.4.2 Rock Foundation - If the trench bottom is in rock the excavation shall be undercut to a minimum depth of 6 inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section pipe. Granular bedding shall be no. 9 crushed stone.

4.4.3 Special Bedding - In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the UTILITY, yielding and mucky material in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Crushed stone or other such granular material, if necessary, as determined by the UTILITY to replace poor subgrade material, shall be classified as "Special Pipe Bedding."

Granular material for "Special Pipe Bedding" shall be KDHS No. 78 stone.

4.5 LAYING PIPE - The laying of sewer pipe in finished trenches shall be commenced at the lowest point so that the spigot or tongue ends point in the direction of flow.

If the CONTRACTOR desires, he may use a laser beam instrument to set the grades on sewer lines in lieu of using a grade string and batter boards set from grade stake. In using such an instrument, the CONTRACTOR shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be corrected by the CONTRACTOR.

All pipe lengths shall be laid with ends butting and true to line and grade as given by the ENGINEER. They shall be fitted and matched so that when laid they will form a sewer with a smooth and uniform invert. Supporting of pipe shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipe on blocks be permitted.

Branches, fittings and specials for sewer lines shall be provided and laid as and where directed by the UTILITY or shown on the plans.

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the UTILITY. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fittings shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth or other material and precautions taken to prevent flotation of pipe by runoff into trench.

4.5.1 Jointing Polyvinyl Chloride Pipe - All joints and connections shall be as established in Section 4.2.1 hereinbefore. Assembly of pipe and fitting joints shall be in accordance with manufacturer's recommendations.

4.5.2 Jointing Ductile Iron Pipe - All joints and connections shall be as established in Section 4.2.2 hereinbefore. Assembly of pipe and fitting joints shall be in accordance with manufacturer's recommendations.

4.5.3 Jointing Cast Iron Soil Pipe - All joints and connections shall be as established in Section 4.2.3 hereinbefore. Assembly of pipe and fitting joints shall be in accordance with manufacturer's recommendations.

4.6 BACKFILLING PIPELINE TRENCHES - All backfilling shall be accomplished in accordance with the details shown on Standard Drawing SD-1 and the requirements of this section. Any variances must be approved in writing by the UTILITY.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill materials or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95 percent of standard (ASTM D698) proctor density where mechanical tamping of backfill is required.

Before final acceptance, the CONTRACTOR will be required to level off all trenches or to bring the trench up to the level of the surrounding terrain. The CONTRACTOR shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

In the event that pavement is not placed immediately following trench backfilling in streets and highways, the CONTRACTOR shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures so not occur.

4.6.1 Method "A" Backfilling in Open Terrain - Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

In all cases the lower portion of the trench, from the pipe bedding to the springline (centerline) of the pipe shall be backfilled with no. 9 crushed stone.

When using ductile iron pipe, the portion of the trench from the springline of the pipe to a point 6 inches above the pipe shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding 1/2-cubic foot is prohibited. This material shall be placed in 6-inch layers and mechanically tamped.

When using PVC pipe and cast iron soil pipe the portion of the trench from the springline of the pipe to a point 12 inches above the pipe shall be backfilled with no. 9 crushed stone.

The upper portion of the trench above the crushed stone portion shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding 1/2-cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the UTILITY. The trench backfill shall be heaped over or leveled.

4.6.2 Method "B" Backfilling Under Paved Areas - Backfilling of pipeline trenches under sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to a point 6 inches below the bottom of the pavement or concrete sub-slab, shall be backfilled with crushed stone or fine gravel. The upper portion of the trench, from a point 6 inches below the bottom of the pavement or concrete sub-slab up to grade, shall be backfilled with crushed stone, fine gravel or sand which is suitable to the governing body having jurisdiction over the street or roadway. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

4.6.3 Settlement of Trenches - Wherever sewer lines are in, or across, driveways and streets, the CONTRACTOR shall be responsible for any trench settlements which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench

settlement within this time, it shall be replaced by the CONTRACTOR. Repair of settlement damage shall meet the approval of the appropriate governing body.

4.7 MANHOLES - Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 400 feet. Manholes of the form and dimensions shown on the approved plans shall be built as directed. The manhole proper shall be constructed of precast concrete rings (see Standard Drawing No. SD-2, 3, and 4). They shall be constructed on 3500 psi concrete foundations. Tops of manholes shall be at ground elevation unless otherwise requested by the UTILITY.

4.7.1 Standard Manholes - The standard manholes shall be 5 feet or more in depth, measured from the base of the cover frame to the top of the concrete footing and shall be of the cone-type top construction as shown on Standard Drawing No. SD-2.

4.7.2 Shallow Manholes - The shallow manholes shall be 5 feet or less in depth, measured from the base of the cover frame to the top of the concrete footing and shall be of flat top construction as shown on Standard Drawing SD-3.

4.7.3 Standard Drop Manholes - A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert and shall be built as a part of the standard manhole. The pipe shall be laid in the manhole as shown on the plans and encased with concrete. The pipe which is laid to the drop portion of the manhole shall be supported with 3500 psi concrete extending from the drop stack to the reinforced base of the manhole as shown on Standard Drawing SD-4. It shall be grouted on the inside and free from invert obstructions.

4.7.4 Precast Concrete Rings - Precast concrete rings for manholes shall conform to ASTM C-47B, Class II, Wall B, with a minimum concrete strength of 4,000 psi, except that rings for manholes over 12 feet deep shall be Class III. O-ring gaskets shall be installed between connected ring sections.

4.7.5 Manhole Inverts - Manhole inverts shall be formed from 3500 psi concrete. Inverts for a "straight-through" manhole shall be formed by laying the pipe straight through the manhole, pouring the concrete invert, and then breaking out the top half of the pipe. Curved inverts shall be constructed of concrete, as shown, and shall form a smooth, even half-pipe section as shown in Standard Drawing SD-5. The inverts shall be constructed when the manhole is being built using prefabricated forms.

The excavation shall be kept free of water while the manhole is being constructed and the manhole shall not be backfilled until inspected by the UTILITY.

4.7.6 Manhole Steps - Manhole steps shall be made of steel reinforced polypropylene plastic as the PS1 manhole step manufactured by M.A. Ind., Inc., Peachtree City, Georgia, or any steel reinforced plastic step which produces equal or better performance.

4.7.7 Manhole Frames and Covers - Manholes frames and covers shall be as follows:

Medium traffic and field  
7" thick @ 350 lbs.  
Heavy traffic  
9" thick @ 450 lbs.

4-inch frames are not permitted. Lockable covers maybe required in certain areas.

Manhole covers must sit neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. They shall have sufficient corrugations to prevent a slipperiness. The lids shall have 2 pick holes about 1-1/4 inches wide and 1/2-inch deep with 3/8-inch undercut all around. Lids on sanitary sewer manholes must not be perforated. Frames must be designed to accept extension rings.

If manhole is located below flood level for 100-year rainfall, watertight manhole castings are required. Watertight manhole castings shall consist of cast iron frames with machined bearings surfaces, gasket seal, and bolted lids. They shall be Neenah R-1916-F or approved equal, as in Drawing SD-11.

4.8 TESTING OF LINES - The testing of gravity sewers shall be accomplished by the CONTRACTOR in accordance with the procedures listed hereinafter.

a. After the collection and/or outfall lines have been brought to completion, and prior to the final inspection, the CONTRACTOR shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the lines of any and all dirt, debris and trash.

b. Prior to the final inspection, the ENGINEER shall inspect each individual line, from manhole to manhole, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the plans.

c. The UTILITY may require that the CONTRACTOR pass through the system under its own momentum, a wooden ball of a diameter 1-inch less than the nominal diameter of the pipe, except that no ball larger than 8 inches in diameter shall be used.

d. All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced.

e. The CONTRACTOR shall lay sewer lines, including house connections, so that the groundwater infiltration shall not average more than 1500 gallons per 24 hours per mile of sewer without regard to the diameter of the sewer. Only the length of the main sewers shall be used in making the foregoing computation even though the house connections (from the main sewer to the property line) should be in place and included as a part of the system when infiltration is measured. This requirement may be applied to a portion of the contract work, such as the sewers in a separate drainage area or to a single section of line between 2 manholes.

f. The UTILITY will also require all sanitary sewers to receive a low-pressure air test for leakage. The air test will be made after all house connections have been installed to property lines and backfilling has been completed and compacted.

The first series of air tests is to be made after 2,000 L.F. of sewer have been laid but before 4,000 L.F. are completed. The purpose of this first series of tests is to assure both the CONTRACTOR and the OWNER that the material and method of installation meet the intent of these specifications. The remainder of the tests are to be conducted after approximately each additional 10,000 L.F. have been laid.

All ties and end of sewer services shall be plugged with flexible joints plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

Prior to testing, the pipe will be checked to see that it is clean. If not, it shall be cleaned by passing through the pipe a full gauge squeegee. It shall be the CONTRACTOR'S responsibility to have the pipe clean.

Immediately following this check or cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe. At least 2 minutes shall be allowed for temperature stabilization.

The requirements of this specifications shall be considered satisfied provided that the time required, in seconds, for the pressure to decrease from 3.5 to 3.0 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe is not less than that shown in the "Allowable Time Table" listed below, which is for 400-foot sections of pipe. For testing of shorter sections of pipe the utility shall determine duration of test.

ALLOWABLE TIME TABLE

Pipe Size	TIME		Pipe Size	TIME	
	Min.	Sec.		Min.	Sec.
6"	2	55	18"	8	30
8"	3	57	21"	9	50
10"	4	43	24"	11	20
12"	5	40	27"	12	45
15"	7	05	30"	14	10

h. In order to test for infiltration, the UTILITY may also require exfiltration tests on each section of pipe between manholes after it has been laid but prior to backfilling of joints. Exfiltration tests shall be conducted by plugging the lower end of the section of sewer to be tested and filling the sewer with water to a point approximately 5 feet above the invert at the lower end and at least one foot above the pipe at the upper end, observing for leakage at all joints and measuring the amount of leakage for a given interval of time. Exfiltration shall not exceed 110 percent times the infiltration limits set out hereinbefore. All observed leaks shall be corrected even though exfiltration is within the allowable limits. Exfiltration tests will normally be required for flat sections of sewer that are expected to be below the wet season groundwater table.

i. To test for infiltration, the UTILITY may also require that the CONTRACTOR plug the open ends of all lines at the manhole so that measurements may be made at each section of the sewer line. This infiltration test will not be made until the sewer line is completed, and the CONTRACTOR will be required to correct all connections that are conducive to excessive infiltration and may be required to relay such sections of the line that may not be corrected otherwise. All observed leaks shall be corrected even though infiltration is within allowable limits.

4.8.1 Special Deflection Testing - In addition to the requirements of 4.8.1, all PVC gravity sewer lines shall be deflection tested. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5 percent. If the deflection

test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices. Pipe deflection shall be measured and recorded by the CONTRACTOR in the presence of the ENGINEER using appropriate methods approved by the pipe manufacturer and acceptable to the ENGINEER.

4.9 HOUSE CONNECTIONS - The UTILITY shall approve the location of the points on the collector sewers where tees and wyes are to be installed for house connections. The CONTRACTOR shall lay the house connection lines from this point to the property line, or easement line.

All house connections, unless otherwise specified or directed, shall be 4-inch PVC, or cast iron soil pipe as specified hereinbefore. Laying, joints and backfilling shall conform to the requirements set out herein. All open ends shall be sealed with standard plugs to the satisfaction of the UTILITY. To protect the sealed end from trenching equipment, a no. 4 bar four feet long shall be placed in the trench at a 45° angle 6 to 12 inches from the sealed end. Note Standard Drawing SD-6, 7 and 8.

For shallow sewers (10 feet or less in depth) in rock or earth trenches, the tees shall be encased entirely with crushed stone (Kentucky Highway Department Size No. 78) and fully compacted.

House connections pipe shall be the same as used in the collector lines and shall be placed between the tee branch to customer property line, except for sewer line construction in new subdivision. In which case the house connection pipe shall be extended 10 feet inside the property line. The pipe shall be laid on a uniform grade from the tee branch to meet the probable building sewer grade at the street right-of-way line so that no bends will be needed for the final connection.

For deep sewers (greater than 10 feet in depth) in rock, the tees shall be encased entirely with Class "B" concrete. House connections in this case shall be a combination of cast iron pipe, cast iron bends, and standard adapter and sewer pipe of same material used for collector lines, extended from the tee to the property line. The cast iron pipe shall be laid vertically from the

branch to a point to meet the probable building sewer grade. From this point the appropriate pipe (pipe same as used in collector lines) shall be laid on a uniform slope to match the probable grade of the building sewer.

Under normal conditions, where elevations are not critical, house connection pipe shall be laid on a slope of not less than 1 foot per 100 feet (approximately 1/8-inch per foot). Where elevations are critical, minimum grade may be 0.5 foot per 100 feet laid with batter boards and grade line string, same as specified for main sewers.

The tapping of house connections into manholes on the newly constructed sewers will not be permitted, except where approved by the UTILITY. Where it is necessary to do so, the invert of the house connection shall not be higher than a point 3 inches below the top of the bench to prevent the accumulation of solids on the bench. If necessary, a standard drop connection shall be provided for a house connection that is tapped into a manhole.

The installation of house connections shall follow immediately or be concurrent with the construction of the main sewer. This method of construction will permit more advantageous handling of backfilling and will also avoid possible damage to the main sewer by subsequent exposure for connection of the service lines.

#### 4.10 CONNECTIONS TO EXISTING LINES -

The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sewers to an existing collector line. A representative of the UTILITY must be present while the connection is being made. The UTILITY should be given at least a 24-hour advance notice before the connection is made.

#### 4.11 CONNECTIONS TO EXISTING

MANHOLES - The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sanitary sewer or force main to an existing manhole. A representative must be present while the connection is being made. The UTILITY should be given at least a 24-hour advance notice before the connection is made.

4.12 CONCRETE CRADLE, ANCHORS OR ENCASEMENT - Concrete cradle, anchors or encasement of sewer lines and/or fittings shall be placed where shown on the plans. Concrete shall be Class "B" and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

#### 4.13 LOCATING NEAR WATER MAINS

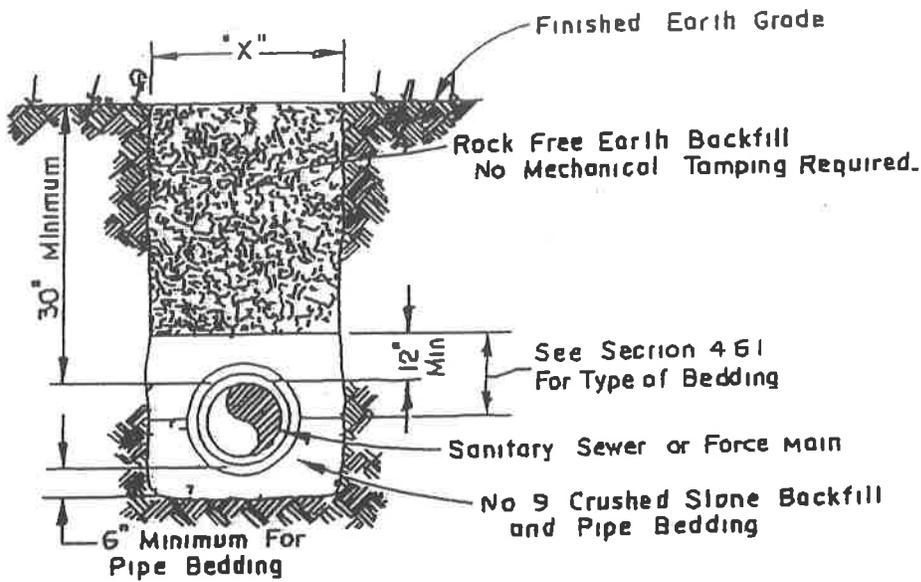
4.13.1 Horizontal Separation - Sewers and sewer manholes shall be laid at least 10 feet horizontally from any existing or proposed water main, to meet Kentucky Division of Water Requirements.

4.13.2 Vertical Separation - Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 24 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirements, the water main shall be relocated to provide this separation or the sewer line shall be reconstructed with slip-on or mechanical-joint cast iron pipe, approved pressure pipe or prestressed concrete cylinder pipe for a distance of 10 feet of each side of the water line and should be pressure tested, in place, without leakage prior to backfilling. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

#### 4.14 HIGHWAY AND RAILROAD CROSSINGS-

Steel encasement pipe for road and railroad crossings shall be bored and/or jacked in place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth, nonobstructing joint inside. The encasement pipe shall be installed without bends. The sewer line pipe shall be installed after the encasement pipe is in place.

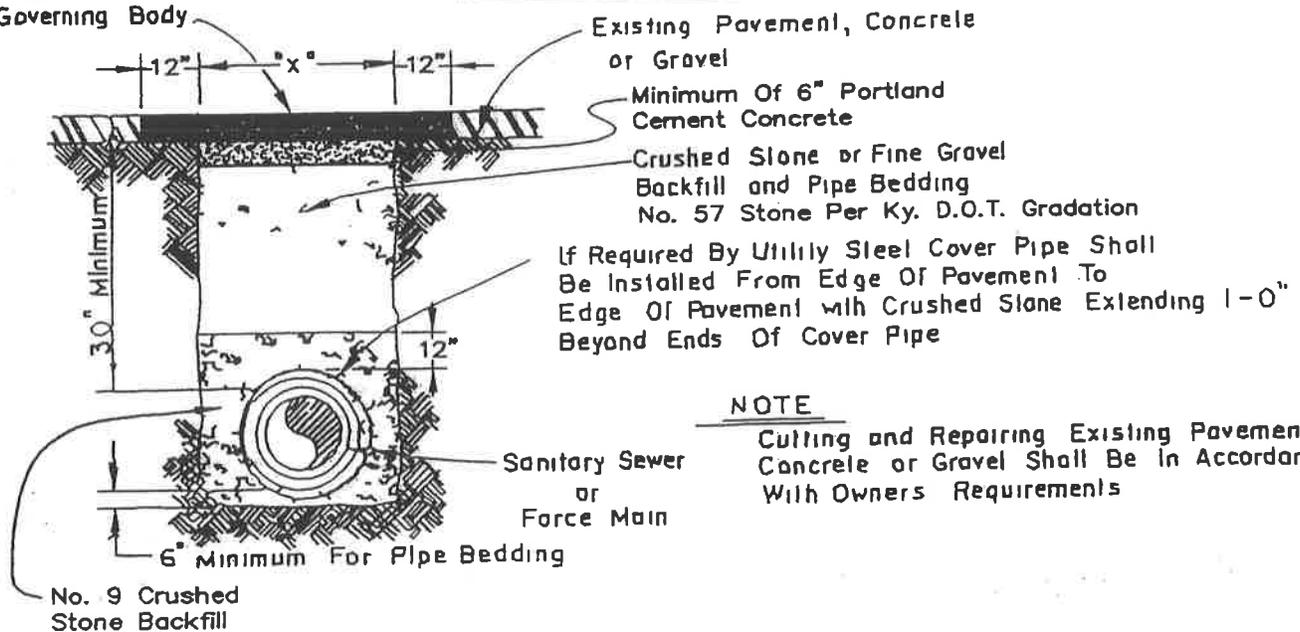
Installation of the sewer line in the encasement pipe shall be as per manufacturer's recommendations. After the sewer main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed in a manner acceptable to the UTILITY and per detail of these standards.



— M E T H O D " A " —  
OPEN AREAS

TRENCH WIDTH	
PIPE SIZE	"X"
4" Thru 12"	30"
14" Thru 18"	36"
20" Thru 24"	42"
26" Thru 36"	54"

Pavement Replacement To Meet The Requirements Of The Appropriate Governing Body



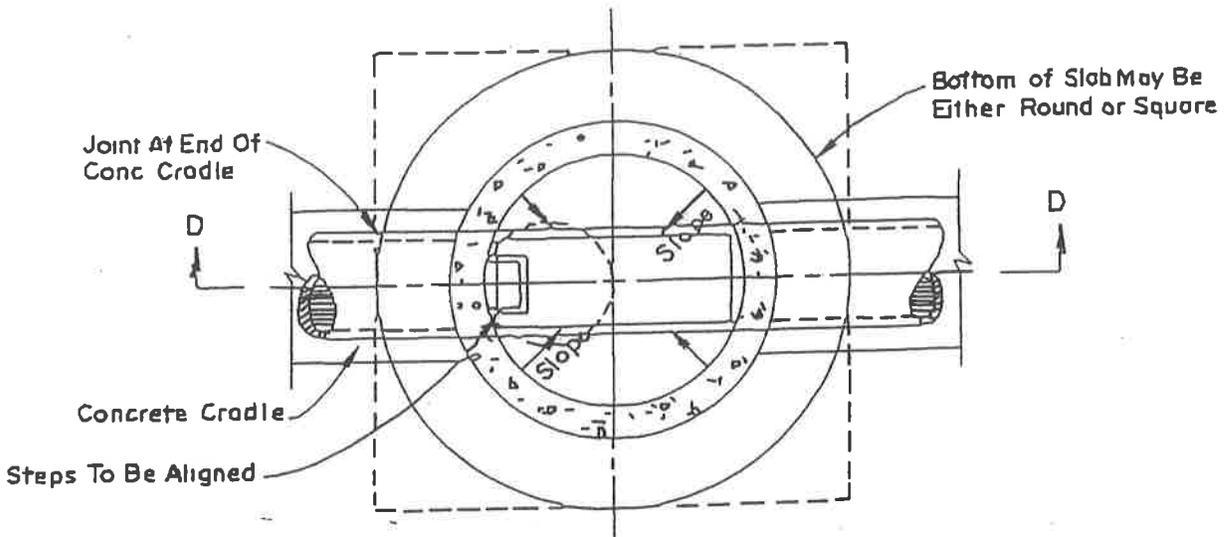
NOTE

Cutting and Repairing Existing Pavement, Concrete or Gravel Shall Be In Accordance With Owners Requirements

— M E T H O D " B " —  
PAVED AREAS

I:\PROEPT\254\254-356\SD-1.DWG

STANDARD DRAWING		TYPICAL BACKFILL & BEDDING METHODS	
		SEWER DIVISION	DWG. NO. SD-1



Manhole Frame & Cover  
(Refer To Std Circular  
Manhole Frame & Cover)

**SECTION C-C**

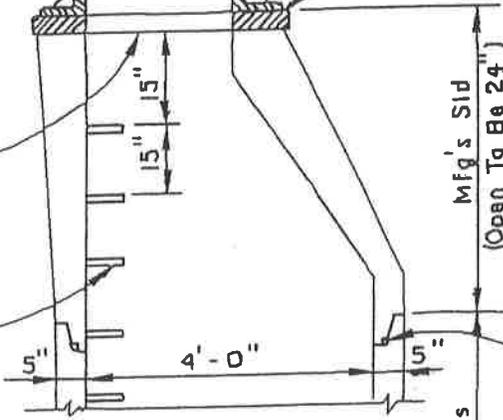
Set Frame Casting In Full  
Portland Cement Mortar Bed

Grade  
Precast Ring Adjusting  
Collar Limited To 3"  
Including Mortar Joint

Plastic Coated M.H. Steps  
(No 3 Deformed Steel Rad  
Mfg MA Ind, Inc )

**NOTE:**  
M.H. To Be Set On  
Foundation Of 6" Bed Of  
#9 Crushed Stone  
Foundation To Be Set On  
Undistrubed Soil Or Fill  
Material Compacted To  
90% STD Proctor, Compaction  
To Be In 6" Lifts from  
Undistrubed Soil.

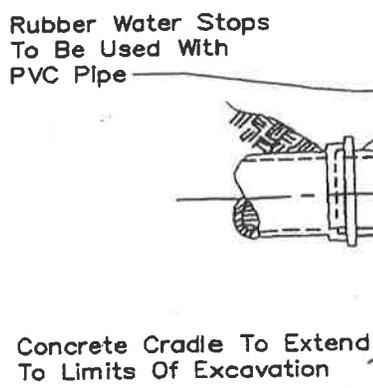
Rubber Water Stops  
To Be Used With  
PVC Pipe



O-Ring Gasket

Precast Conc Rings

Pipe Cut Flush With  
Interior Wall



Concrete Cradle To Extend  
To Limits Of Excavation

Reinforce With #4 Bars  
At 8" OC Both Ways

Conc Cradle On 6 Inch  
Bed Of No 9 Crushed Stone

**SECTION D-D**

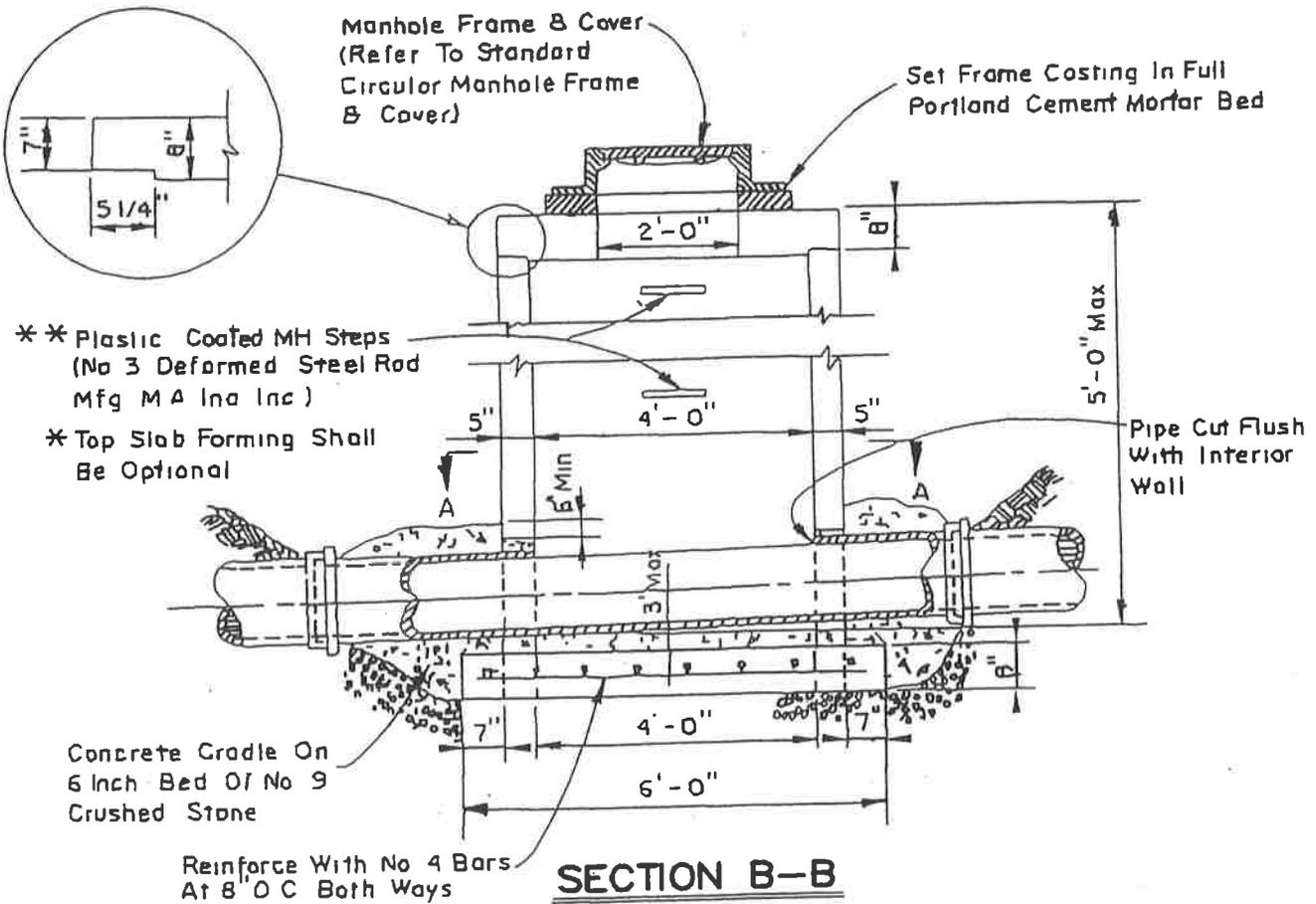
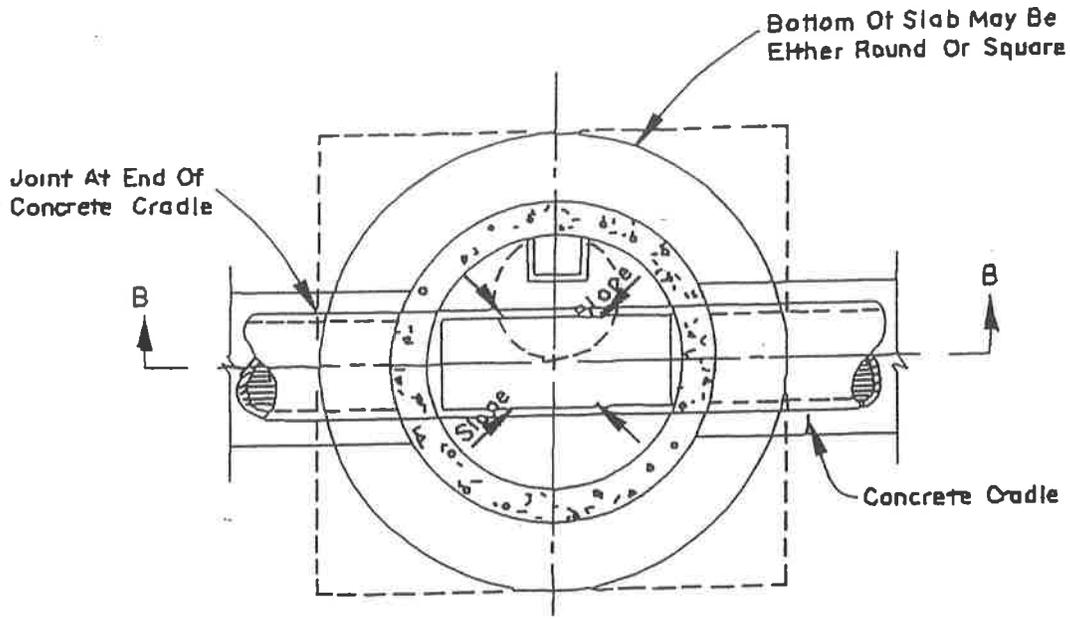
I:\PRODEPT\254\254-356\SD-2.DWG

TYPICAL STANDARD MANHOLE

STANDARD DRAWING

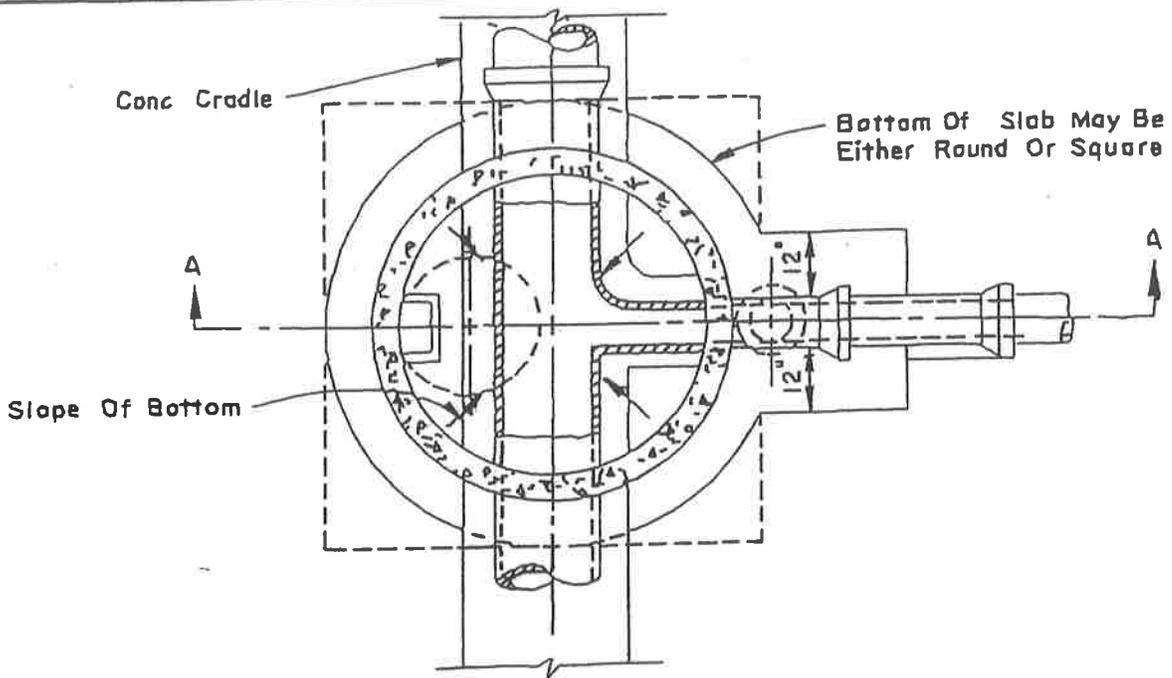
SEWER DIVISION

DWG. No. SD-2



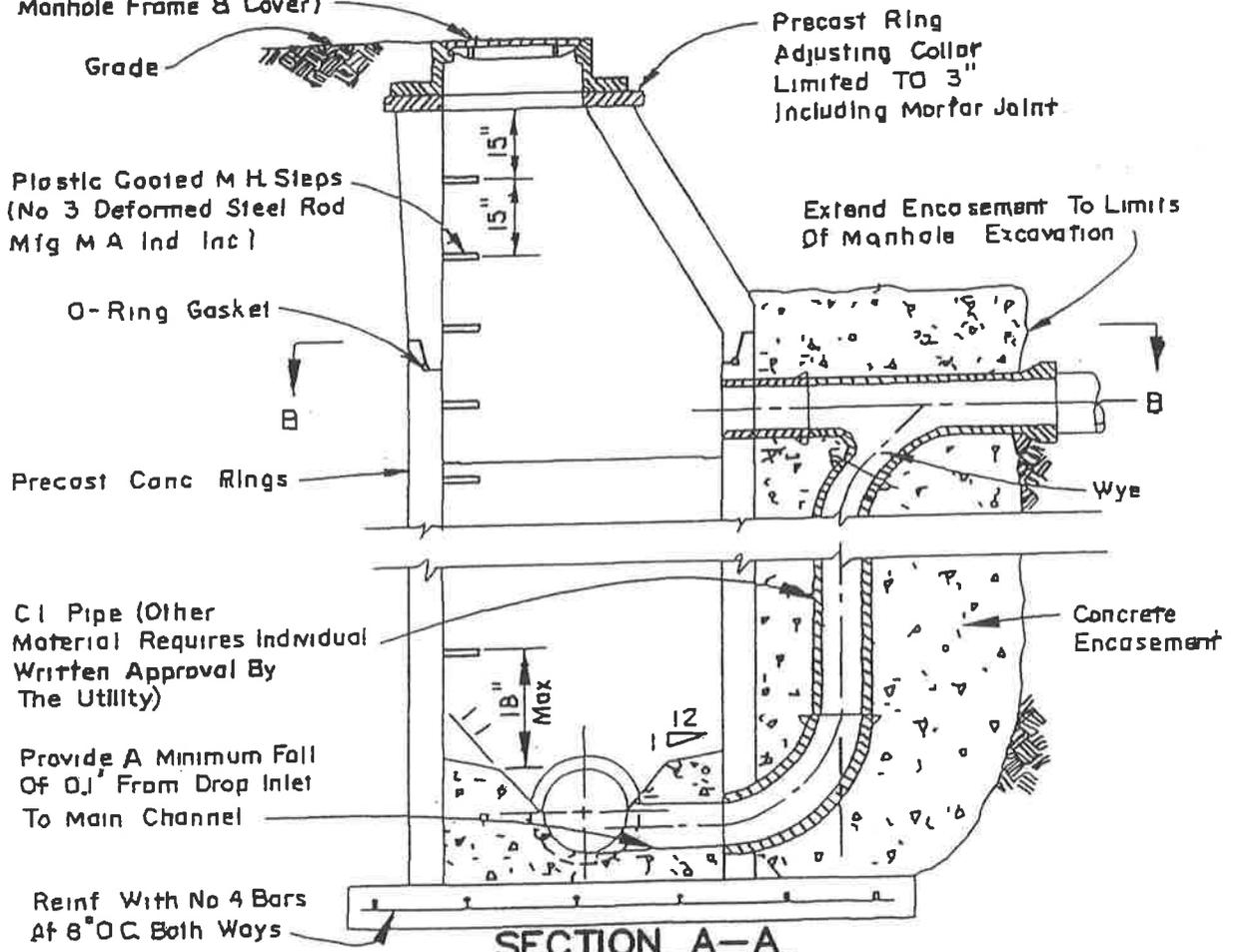
I:\PRODEPT\254\254-356\SD-3.DWG

STANDARD DRAWING		TYPICAL SHALLOW MANHOLE	
		SEWER DIVISION	DWG. No. SD-3



Manhole Frame & Cover  
(Refer To Standard Circular  
Manhole Frame & Cover)

**SECTION B-B**



**SECTION A-A**

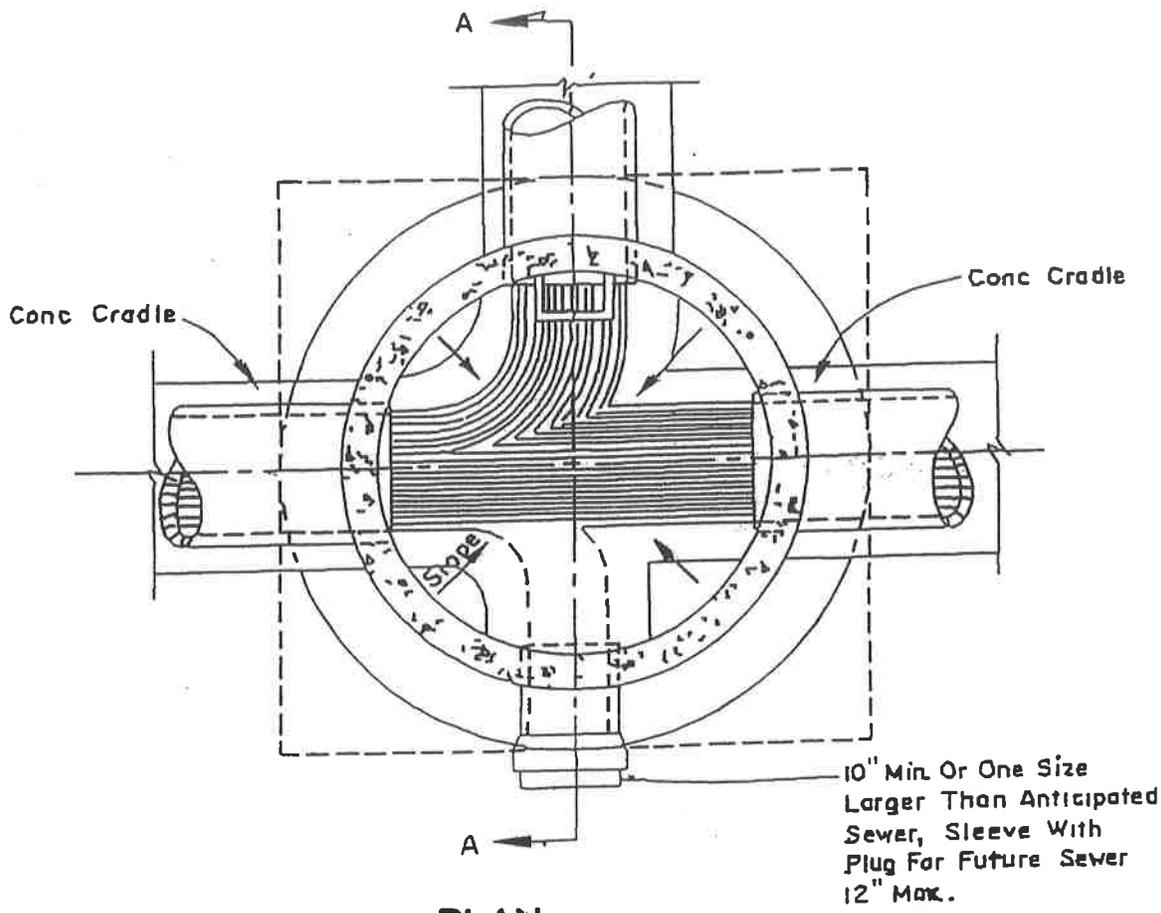
**TYPICAL DROP MANHOLE**

STANDARD DRAWING

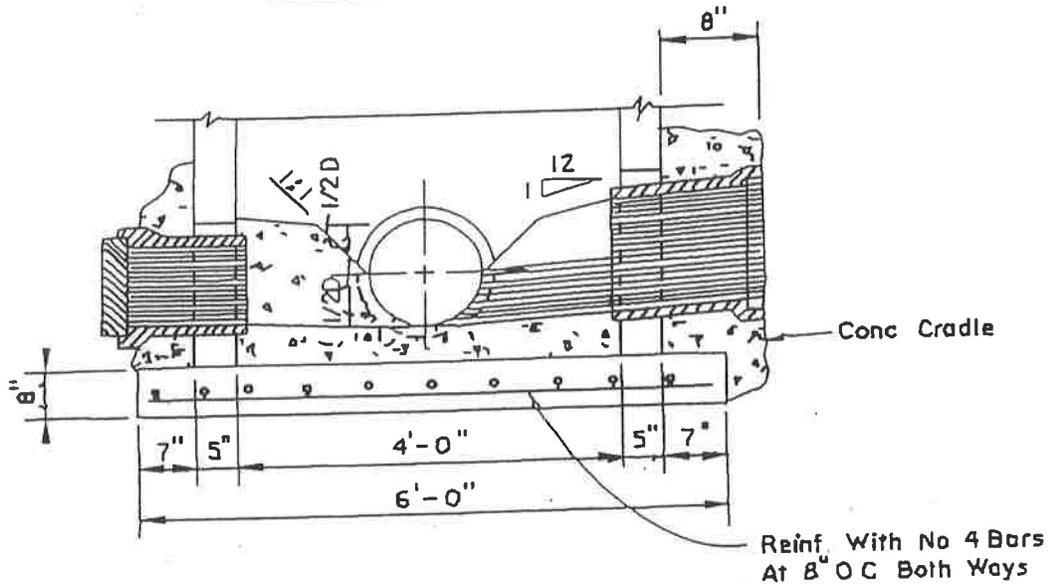
SEWER DIVISION

DWG. No. SD-4

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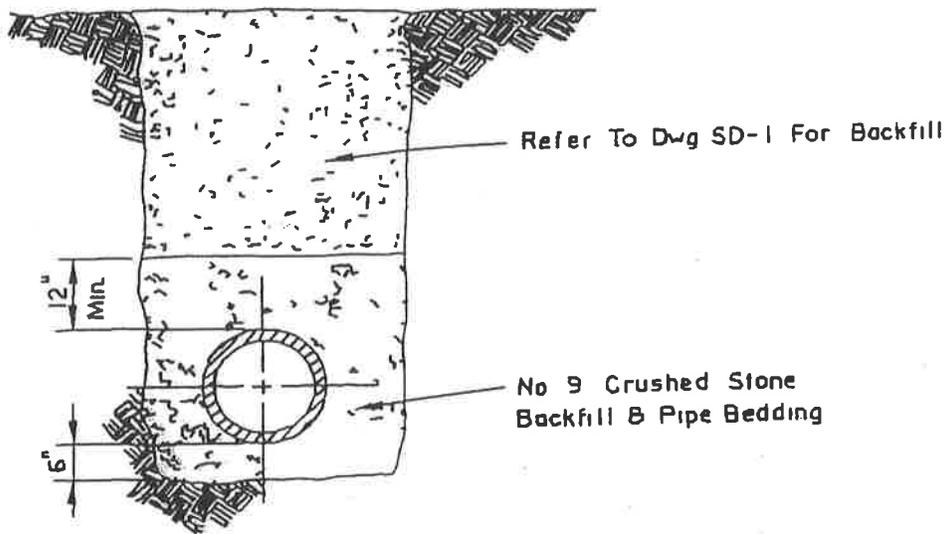
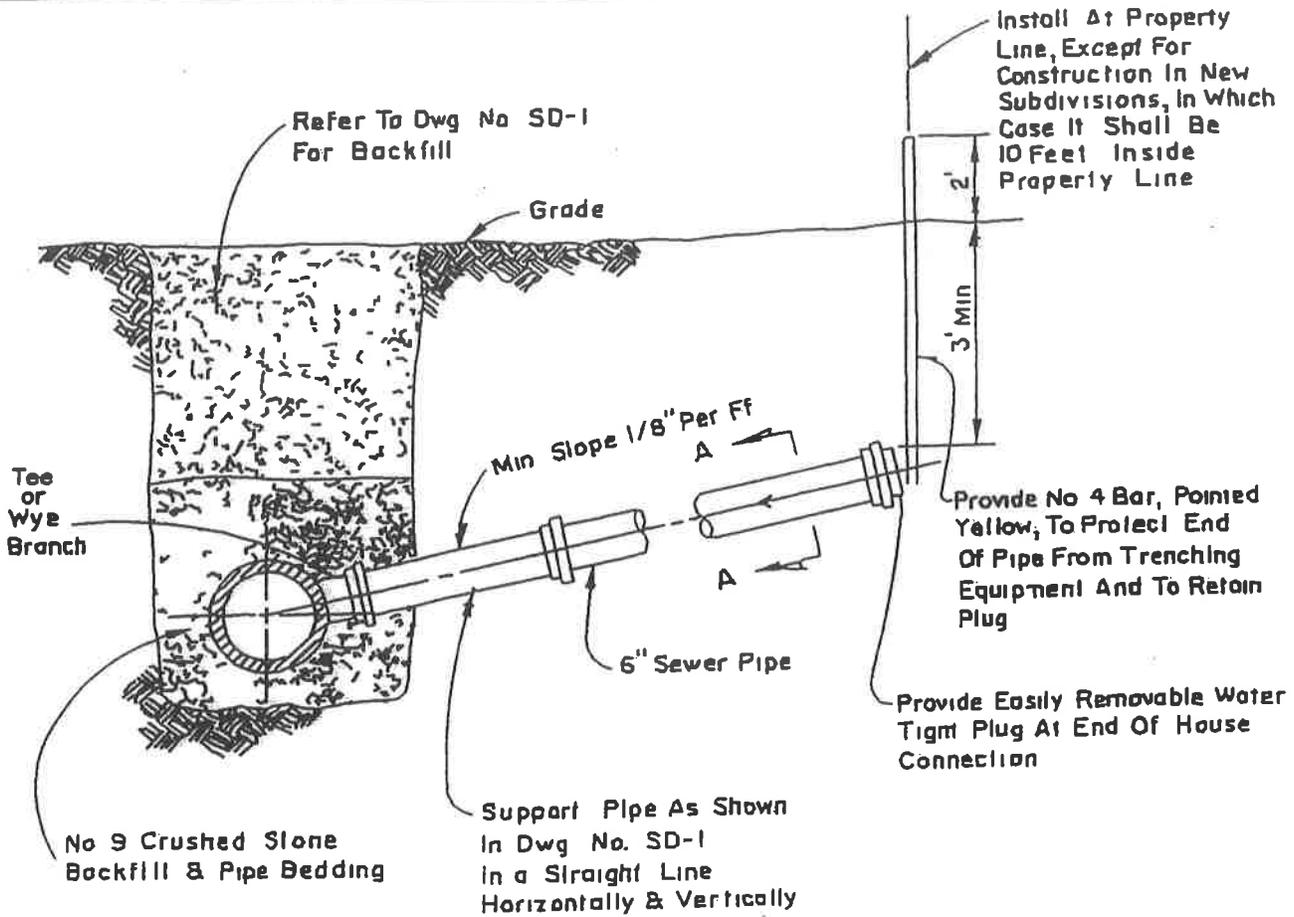
**PLAN**



**SECTION A-A**

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STANDARD DRAWING		STANDARD MANHOLE JUNCTION	
		SEWER DIVISION	DWG. No. SD-5



**SECTION A-A**

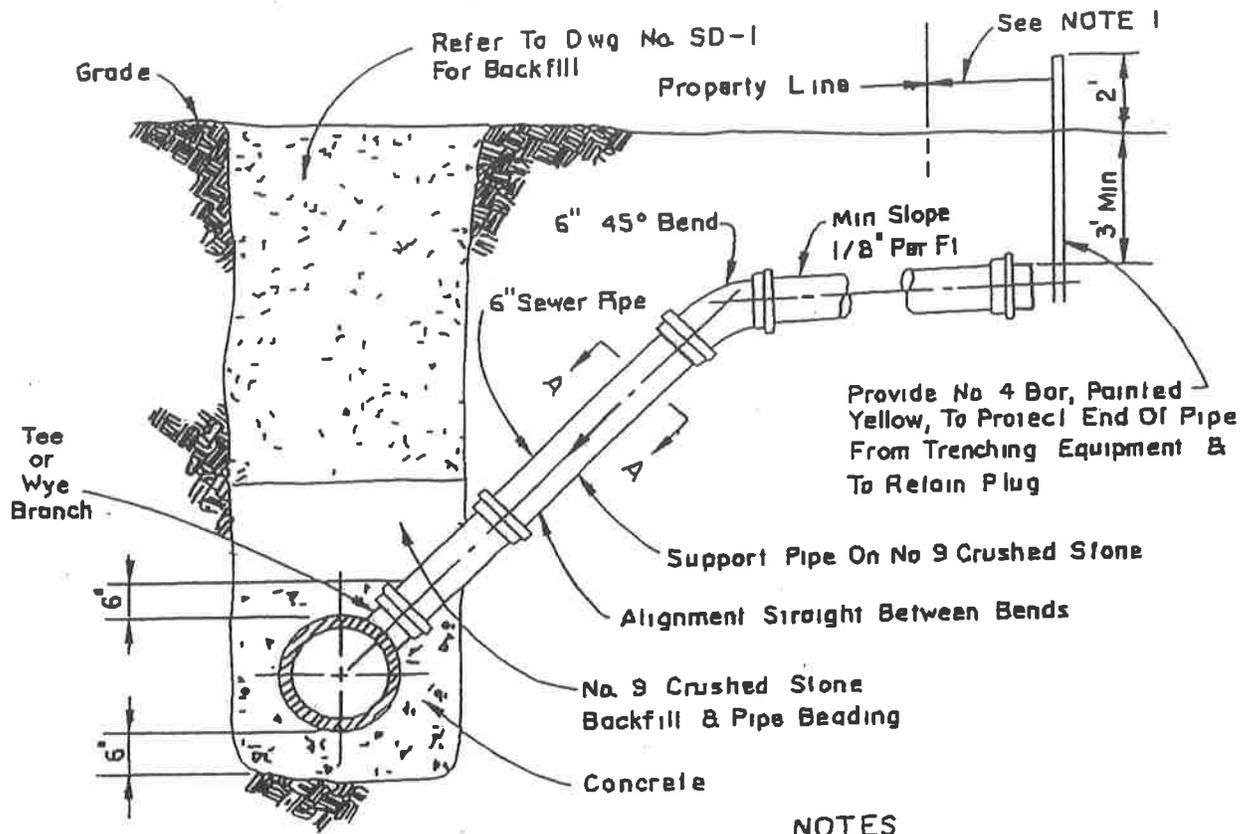
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HOUSE CONNECTION FOR SHALLOW SEWER IN EARTH OR ROCK

STANDARD DRAWING

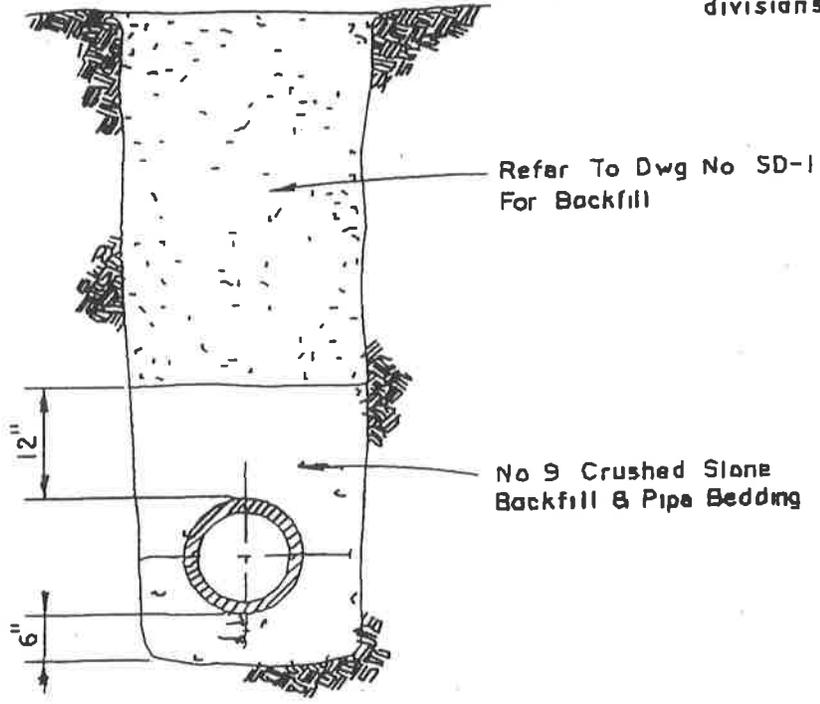
SEWER DIVISION

DWG. No. SD-6



**NOTES**

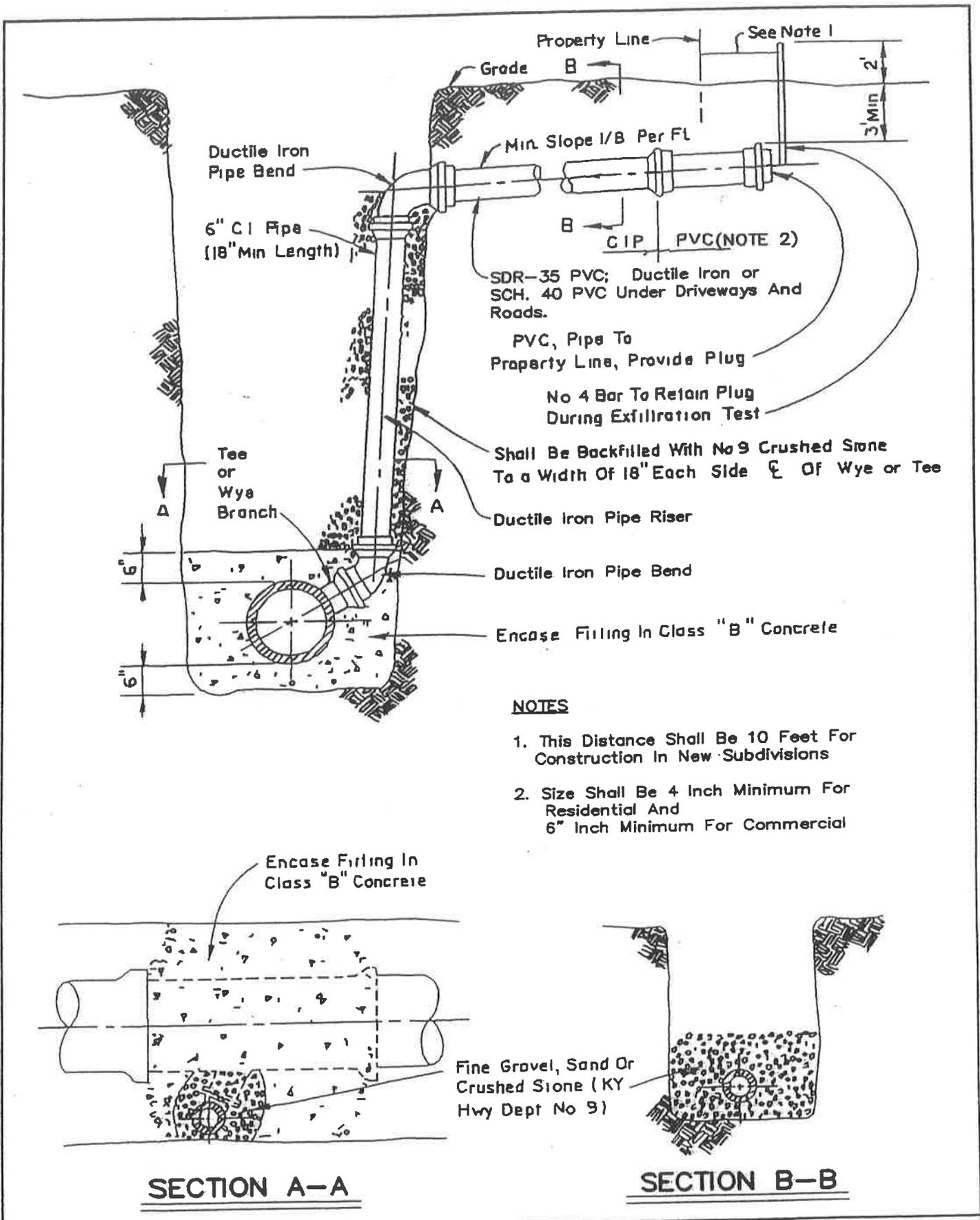
1 This Distance Shall Be 10 Feet For Construction In New Subdivisions



**SECTION A-A**

I:\PROEPT\254\254-356\SD-7.DWG

		HOUSE CONNECTION FOR DEEP SEWER IN EARTH	
STANDARD DRAWING		SEWER DIVISION	DWG. No. SD-7



SDR-35 PVC; Ductile Iron or SCH. 40 PVC Under Driveways And Roads.

PVC, Pipe To Property Line, Provide Plug

No 4 Bar To Retain Plug During Exfiltration Test

Shall Be Backfilled With No 9 Crushed Stone To a Width Of 18" Each Side  $\epsilon$  Of Wye or Tee

**NOTES**

1. This Distance Shall Be 10 Feet For Construction In New Subdivisions
2. Size Shall Be 4 Inch Minimum For Residential And 6" Inch Minimum For Commercial

Encase Filing In Class "B" Concrete

Fine Gravel, Sand Or Crushed Stone (KY Hwy Dept No 9)

**SECTION A-A**

**SECTION B-B**

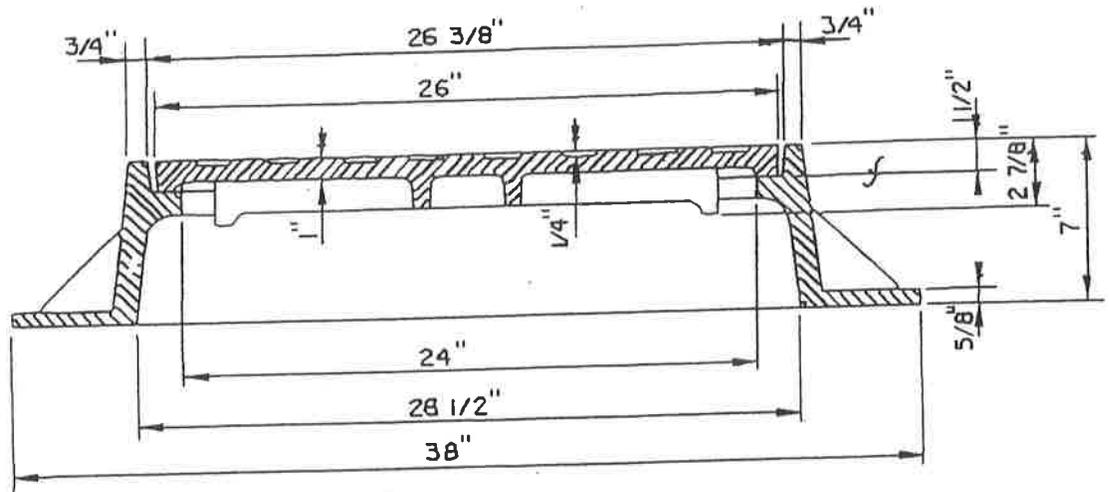
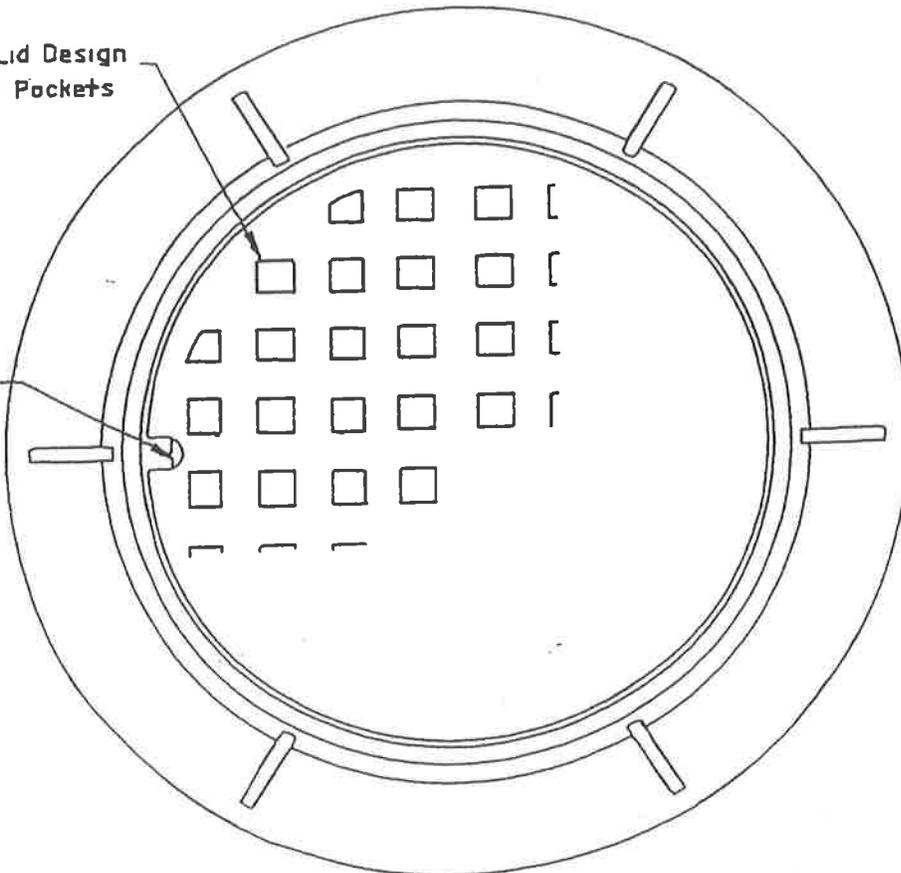
I:\PRODEPT\254\254-356\SD-8.DWG

STANDARD DRAWING		HOUSE CONNECTION FOR DEEP SEWER IN ROCK EXCAVATION	
		SEWER DIVISION	DWG. No. SD-8

NEENAH FOUNDRY COMPANY  
R-1642 FRAME & "B" LID

Type "B" Lid Design  
Depressed Pockets

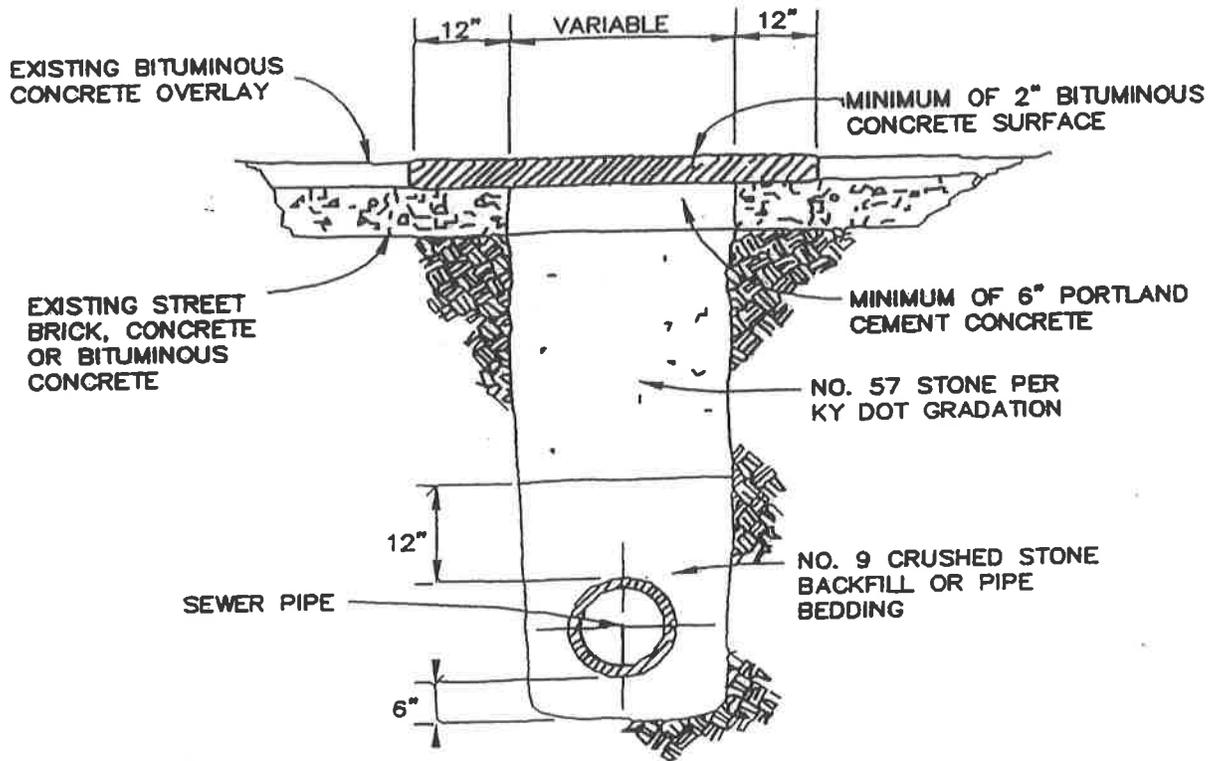
Concealed  
Pickhole



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STANDARD DRAWING		STANDARD CIRCULAR MANHOLE FRAME AND COVER	
		SEWER DIVISION	DWG. No. SD-9

**NOTE:** CONTRACTOR AND/OR UTILITY COMPANY SHALL SAW OR CUT EXISTING STREET SURFACE A MINIMUM DISTANCE OF 12" (INCHES) WIDER THAN THE EXCAVATED TRENCH OR DITCH WALL IN ORDER TO KEY THE FINAL REPLACEMENT SURFACE IN TO THE EXISTING SURFACE.

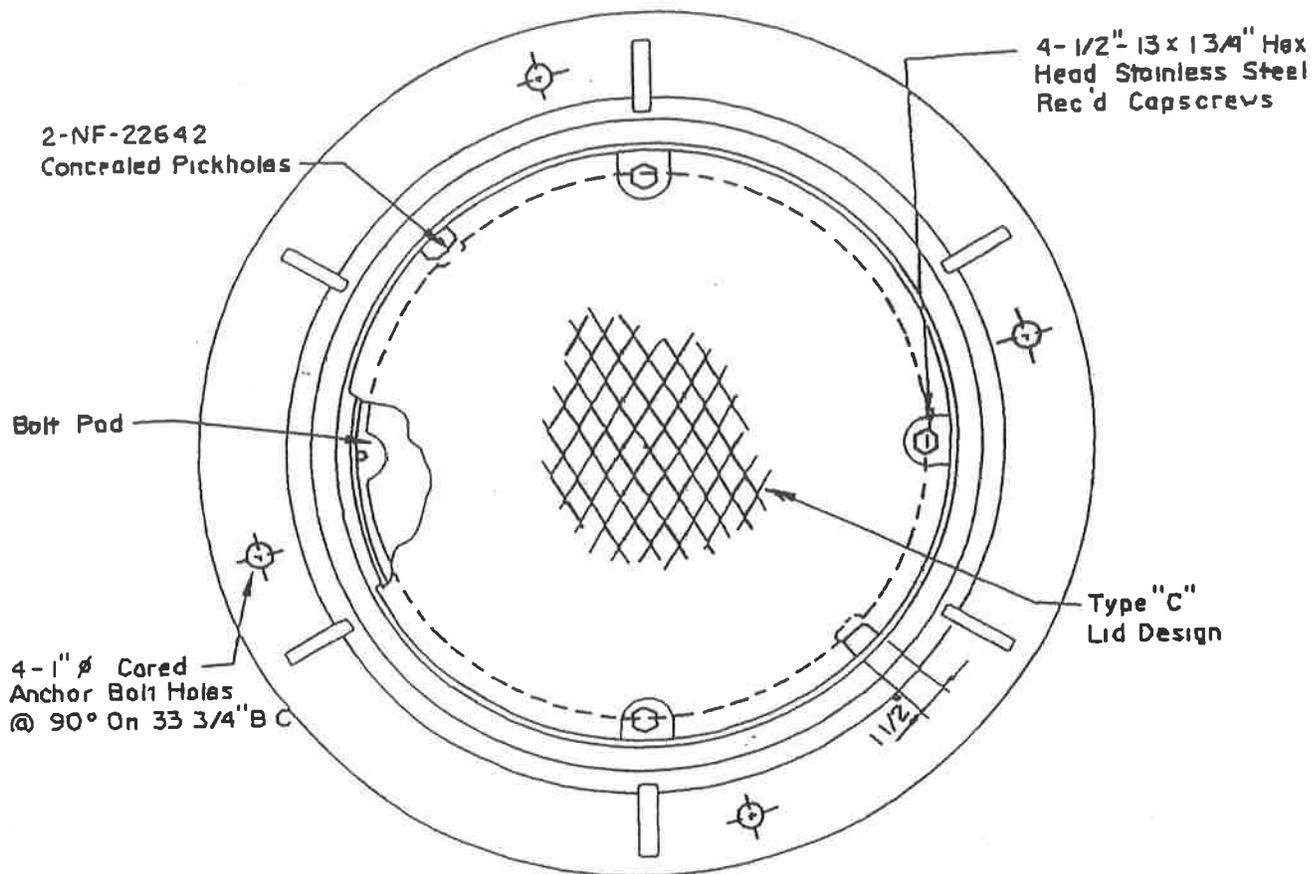


DATE: NOVEMBER 19, 1984  
NO SCALE

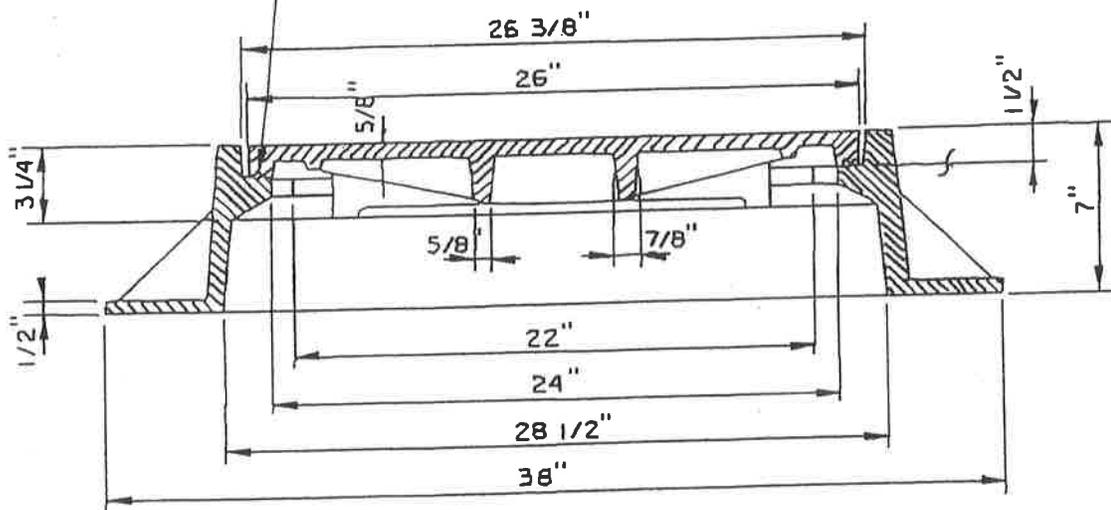
CITY OF MT. STERLING, KENTUCKY  
STANDARD DRAWING  
UTILITY LINES  
TRENCHING STREETS, PLACING BACKFILL  
AND REPLACEMENT OF PAVING

		TRENCH BACKFILL AND PAVEMENT REPLACEMENT ON CITY STREETS	
STANDARD DRAWING		SEWER DIVISION	DWG. No. SD-10

NEENAH FOUNDRY COMPANY  
R-1916F FRAME & LID



1/2" Ø Neoprene Cord  
Gasket 40 Durometer



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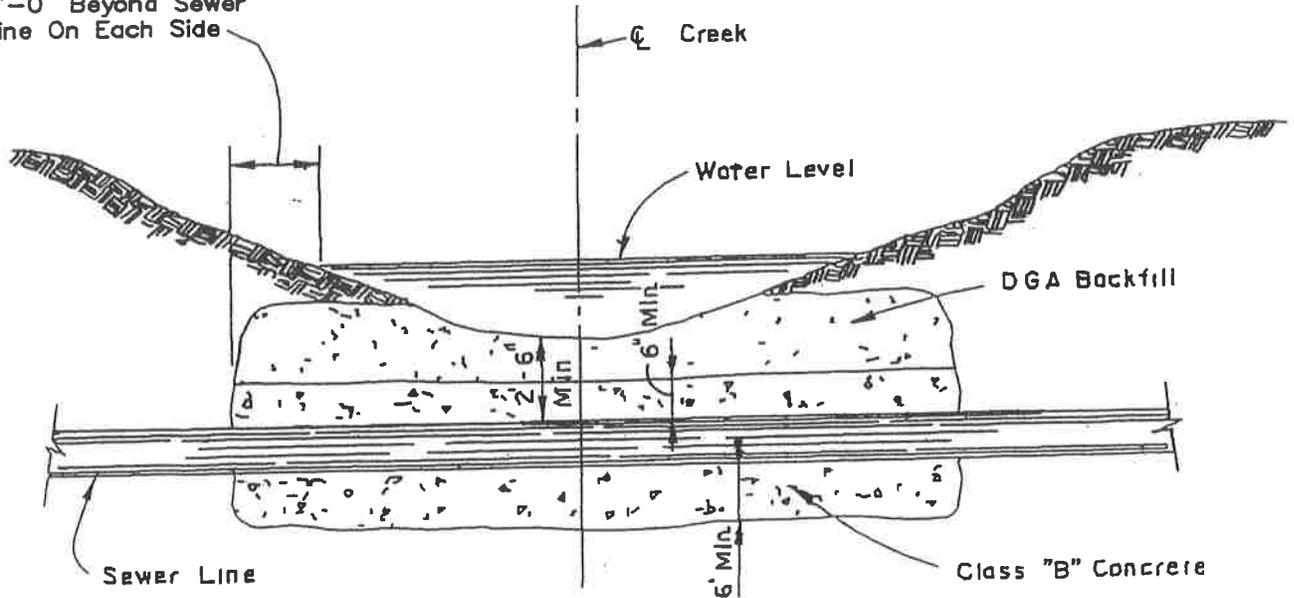
STANDARD WATERTIGHT MANHOLE  
FRAME & COVER

STANDARD DRAWING

SEWER DIVISION

DWG. No. SD-11

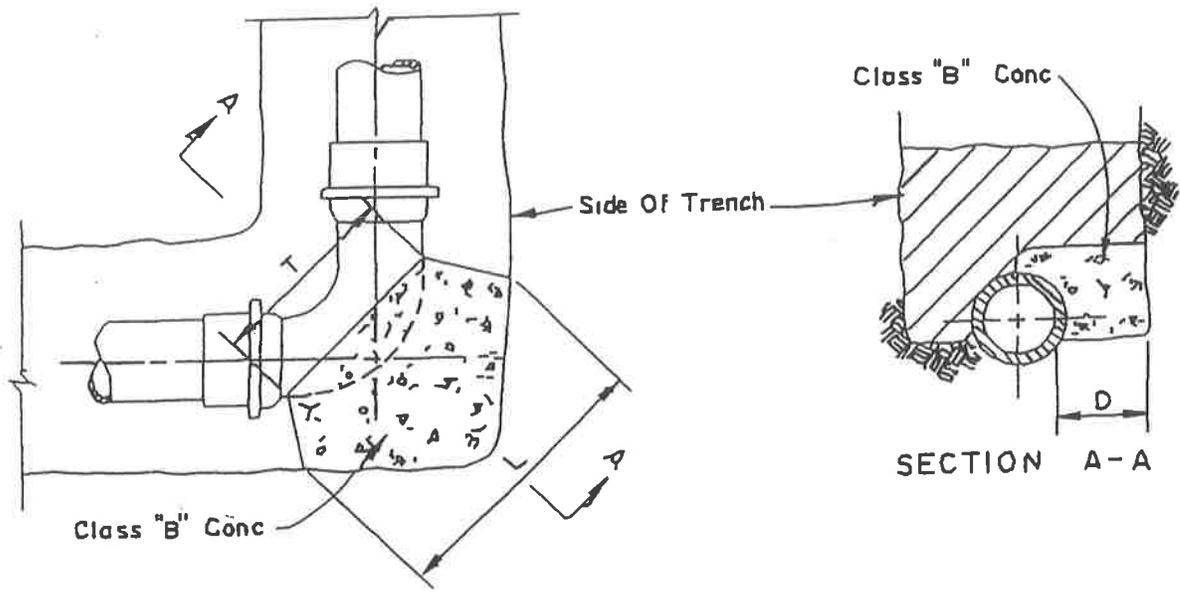
Extend Encasement  
2'-0" Beyond Sewer  
Line On Each Side



TYPICAL CREEK CROSSING FOR  
SANITARY SEWER LINE

I:\PRODEPT\254\254-356\SD-12.DWG

	SEWER LINE ENCASEMENT	
STANDARD DRAWING	SEWER DIVISION	DWG. No. SD-12



**45° & 90° BENDS**

PLUGS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L & W	14"	16"	18"	20"	22"	24"	24"

(45°) EIGHTH BENDS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L	12"	14"	16"	18"	20"	22"	24"
T	10"	12"	14"	16"	16"	18"	18"

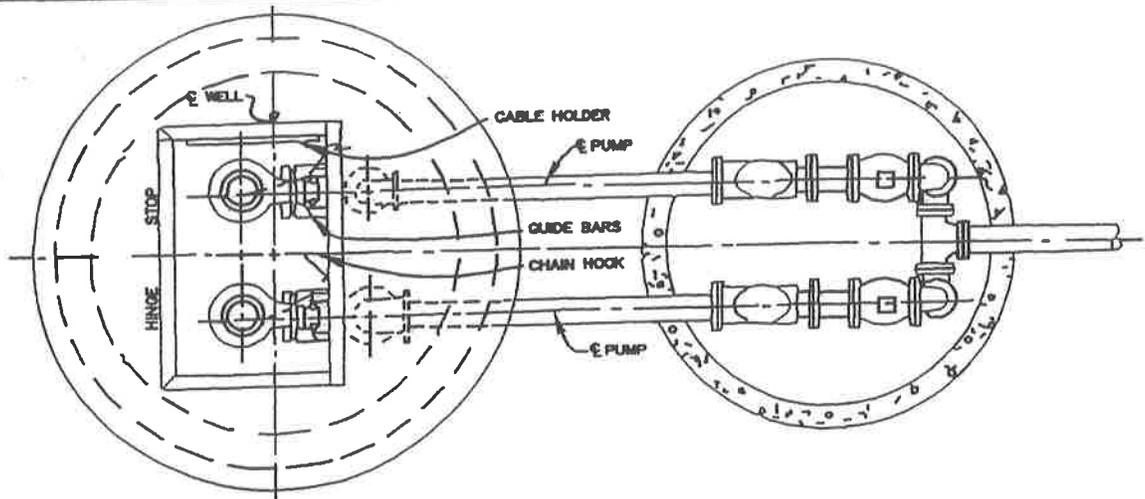
(90°) QUARTER BENDS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	8"	10"	12"	12"
L	15"	18"	21"	24"	27"	30"	34"
T	10"	12"	14"	16"	18"	20"	22"

**NOTE:**

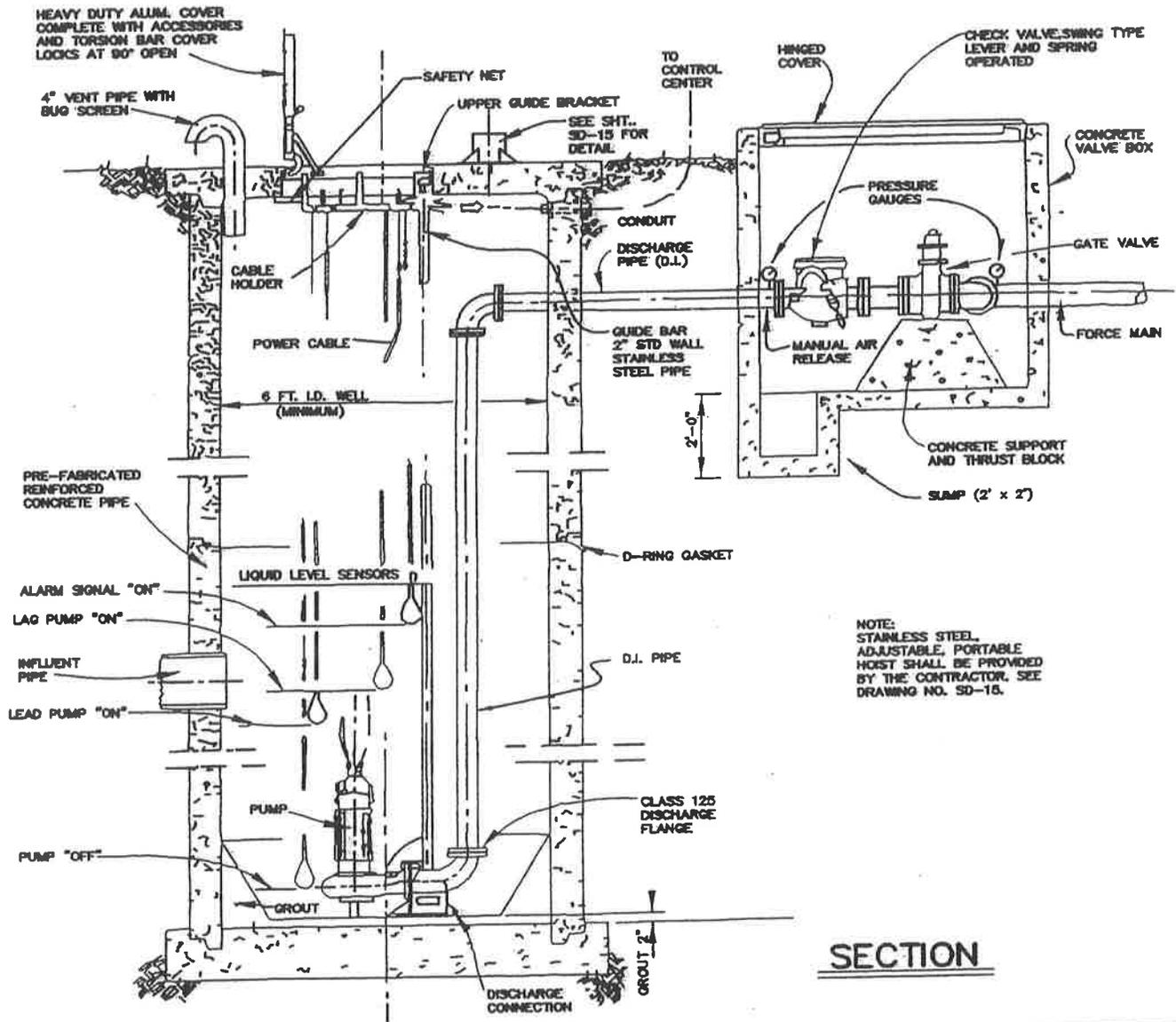
UTILITY RESERVES THE RIGHT TO REQUIRE LARGER THRUST BLOCKS

I:\PRODEPT\254\254-356\SD-13.DWG

		FORCE MAIN THRUST BLOCKS	
STANDARD DRAWING	SEWER DIVISION	DWG. No. SD-13	



**PLAN VIEW**



NOTE:  
STAINLESS STEEL  
ADJUSTABLE, PORTABLE  
HOST SHALL BE PROVIDED  
BY THE CONTRACTOR, SEE  
DRAWING NO. SD-15.

**SECTION**

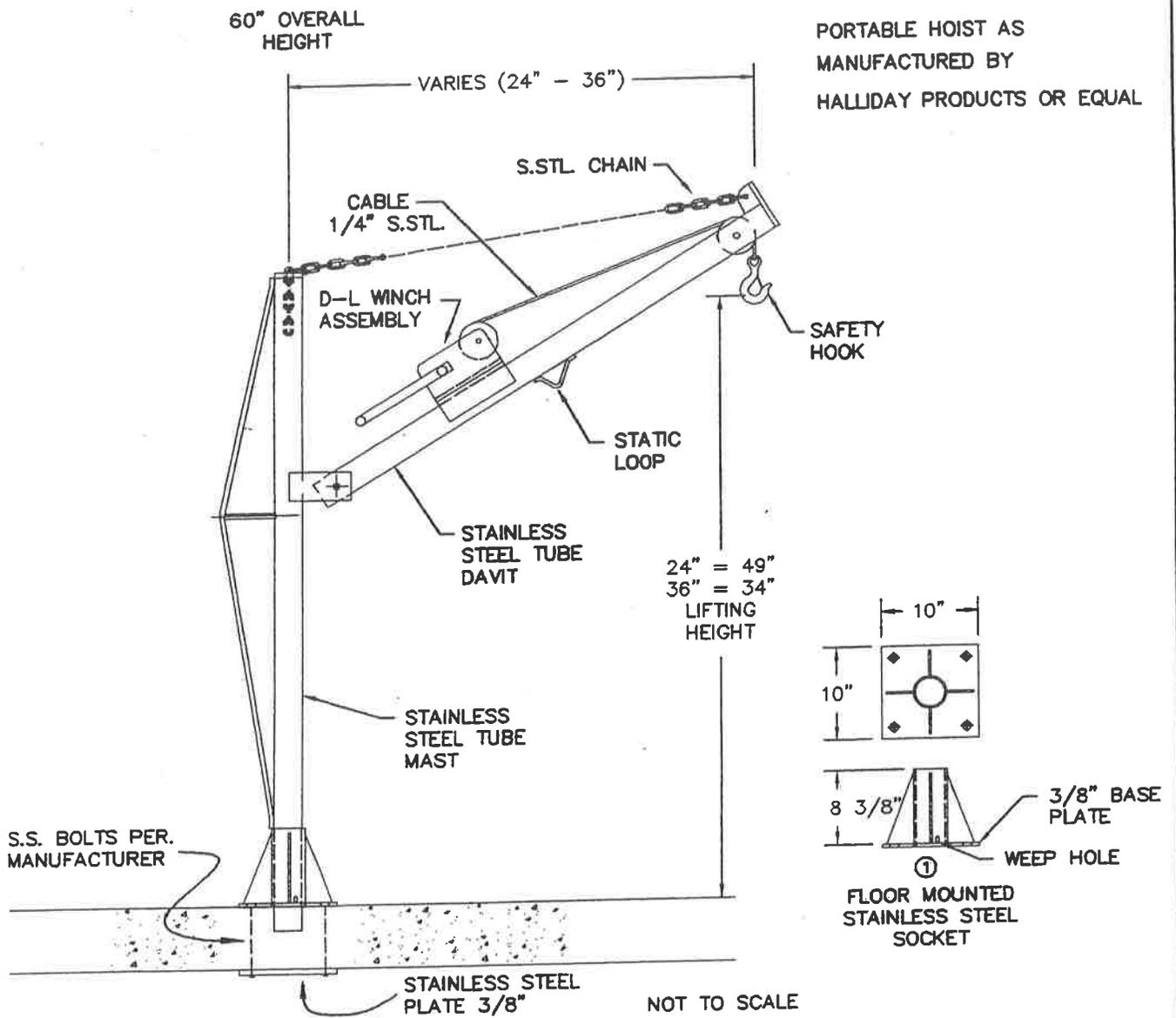
I:\PRODEPT\254\254-356\SD-14.DWG

**TYPICAL SEWAGE PUMPING STATION**

STANDARD DRAWING

SEWER DIVISION

DWG. No. SD-14



# STAINLESS STEEL ADJUSTABLE PORTABLE HOIST

## STANDARD FEATURES:

- STAINLESS STEEL CONSTRUCTION
- ADJUSTABLE REACH
- 30 FEET OF STAINLESS STEEL CABLE AND SAFETY HOOK
- DUTTON-LAINSON HAND WINCH
- FLOOR MOUNTED SOCKET

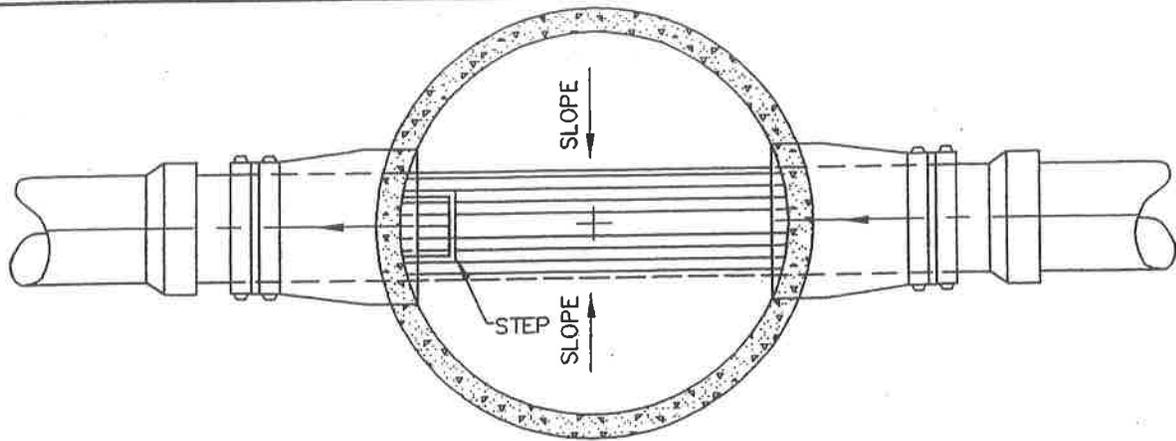
I:\PRODEPT\254\254-356\SD-14.DWG

STANDARD DRAWING

TYPICAL SEWAGE  
PORTABLE HOIST

SEWER DIVISION

DWG. No. SD-15



**LOWER PLAN**

FINAL GRADE SHALL BE  
1/2" TO 1" BELOW TOP  
OF MANHOLE FRAME

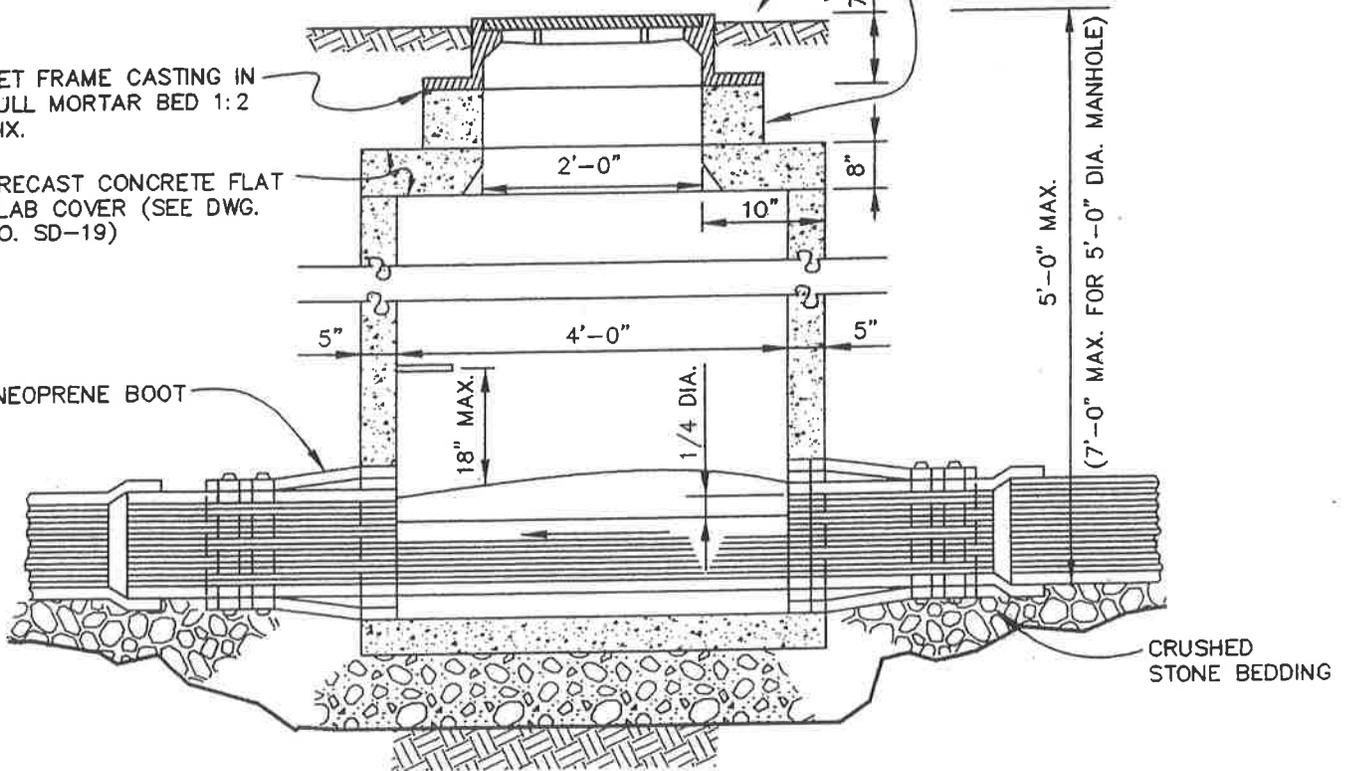
MANHOLE ADJUSTMENT RINGS  
SHALL BE SINGLE PRECAST  
UNITS @ MAXIMUM OF 6"

VARIES  
7" TO 9"

SET FRAME CASTING IN  
FULL MORTAR BED 1:2  
MIX.

PRECAST CONCRETE FLAT  
SLAB COVER (SEE DWG.  
NO. SD-19)

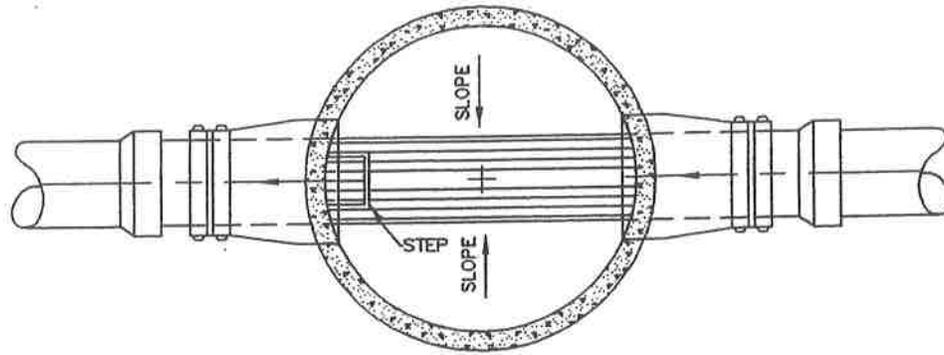
NEOPRENE BOOT



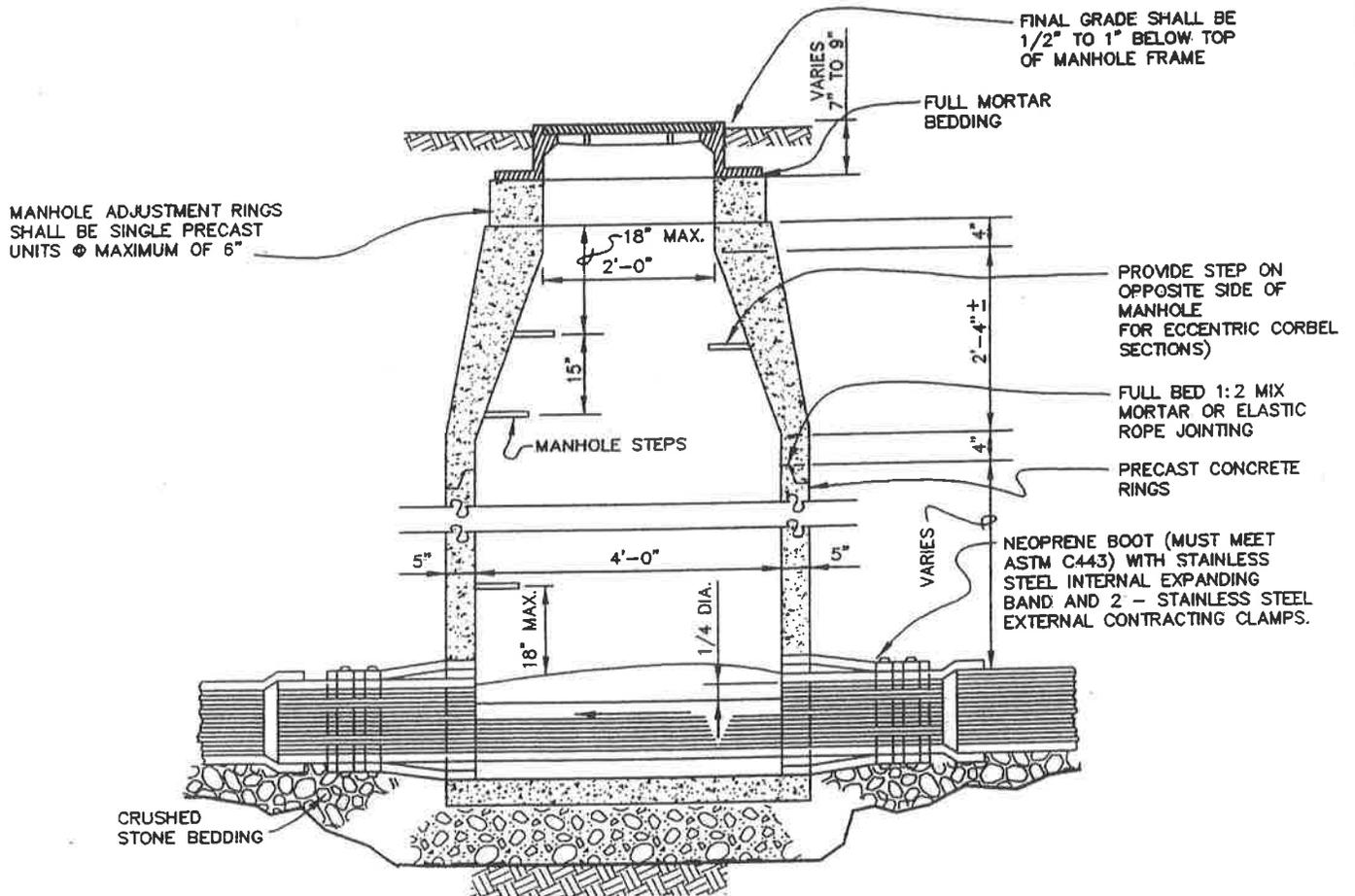
\*\*5'-0" INSIDE DIAMETER USED ON 30" AND LARGER SEWER LINES.  
\*5'-0" INSIDE DIAMETER USED ON 15" AND LARGER SEWER LINES  
WHEN LINE TURNS 45° OR MORE.

**SECTION  
SHALLOW MANHOLE  
PRECAST CONCRETE MANHOLE**

STANDARD DRAWING		TYPICAL SHALLOW PRECAST CONCRETE MANHOLE	
		SEWER DIVISION	DWG. No. SD-16



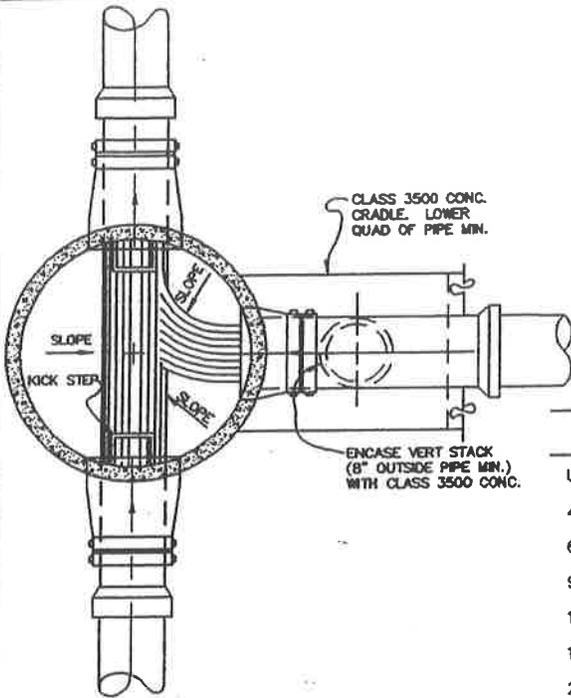
LOWER PLAN



SECTION  
STANDARD MANHOLE

PRECAST CONCRETE MANHOLE

		TYPICAL PRECAST CONCRETE MANHOLE	
STANDARD DRAWING		SEWER DIVISION	DWG. No. SD-17



**LOWER PLAN**

PIPE SUPPORT TABLE			
SPAN	"T"	STEEL	SEAT "B"
0' - 4'	7"	3 - #5	1' - 0"
4' - 6'	9"	3 - #5	1' - 0"
6' - 8'	11"	3 - #7	1' - 6"
8' - 10'	13"	3 - #8	1' - 9"
10' - 12'	15"	3 - #9	2' - 0"

\* REINFORCING SHOWN IS THE MINIMUM ALLOWED & SHALL BE PLACED WITH 2" COVER IN BOTTOM OF CRADLE INCREASE THE NUMBER OF RODS BY ONE FOR EACH 6" INCREMENT THAT CRADLE WIDTH EXCEEDS 1' - 6". (I.E. FOR CRADLE SPAN OF 7' & CRADLE WIDTH OF 2'-6", USE 5-#7)

**BOTTOM MANHOLE SLAB REINFORCING - EACH WAY (1 1/2" COV. TOP)**

DEPTH H	4'-0" I.D. MH	5'-0" I.D. MH	6'-0" I.D. MH
UP TO 4'-0"	NO REINFORCING	NO REINFORCING	NO REINFORCING
4'-0"(+-)-6'-0"	NO REINFORCING	NO REINFORCING	#4 @ 12"
6'-0"(+-)-9'-0"	NO REINFORCING	#4 @ 12"	#4 @ 12"
9'-0"(+-)-12'-0"	#4 @ 12"	#4 @ 12"	#4 @ 12"
12'-0"(+-)-17'-0"	#4 @ 12"	#4 @ 12"	#4 @ 12"
17'-0"(+-)-22'-0"	#4 @ 12"	#4 @ 9"	#4 @ 8 1/2"
22'-0"(+-)-27'-0"	#4 @ 11"	#4 @ 7"	#4 @ 7"
27'-0"(+-)-32'-0"	#4 @ 9"	#4 @ 6"	#4 @ 6"

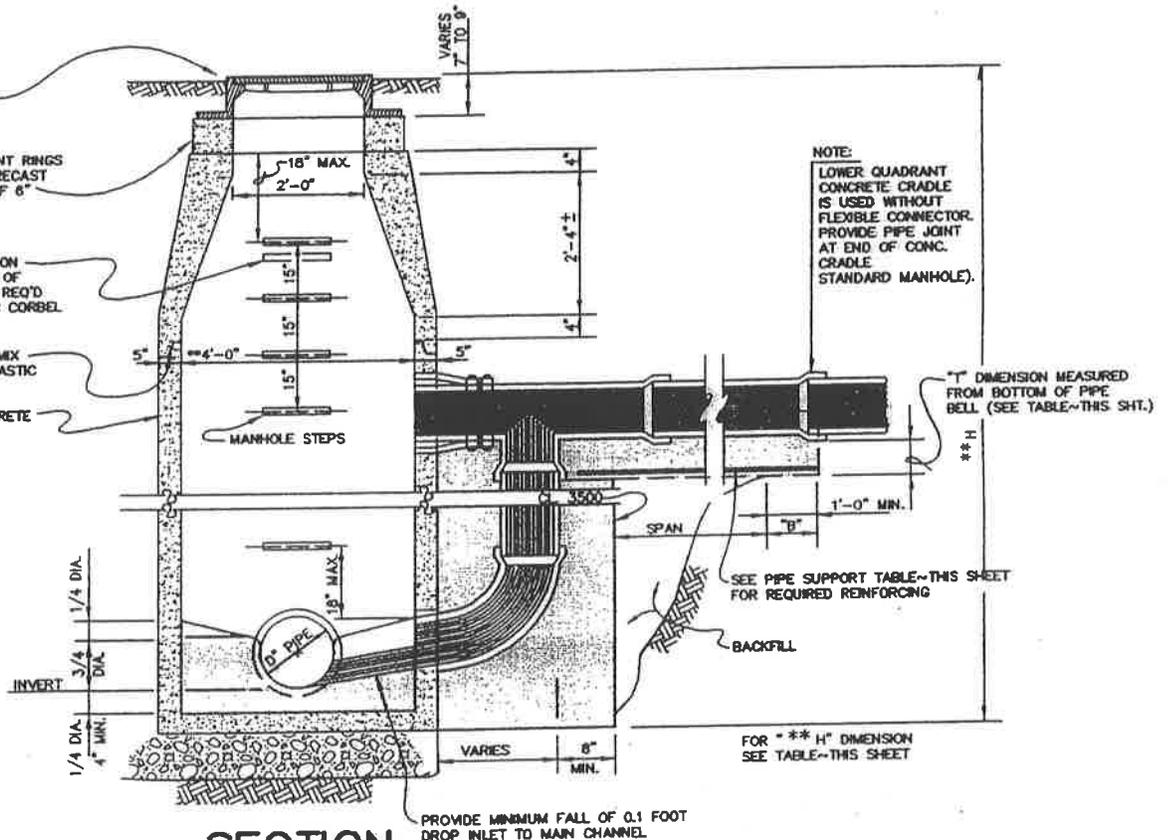
FINAL GRADE SHALL BE 1/2" TO 1" BELOW TOP OF MANHOLE FRAME

MANHOLE ADJUSTMENT RINGS SHALL BE SINGLE PRECAST UNITS @ MAXIMUM OF 6"

PROVIDE STEP ON OPPOSITE SIDE OF MANHOLE (NOT REQ'D FOR ECCENTRIC CORBEL SECTIONS)

FULL BED 1:2 MIX MORTAR OR ELASTIC ROPE JOINTING

PRECAST CONCRETE RINGS



NOTE:  
LOWER QUADRANT CONCRETE CRADLE IS USED WITHOUT FLEXIBLE CONNECTOR. PROVIDE PIPE JOINT AT END OF CONC. CRADLE STANDARD MANHOLE.

"T" DIMENSION MEASURED FROM BOTTOM OF PIPE BELL (SEE TABLE THIS SHIT.)

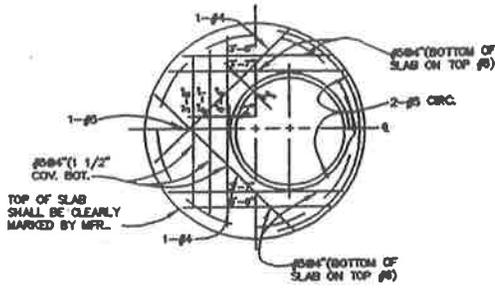
SEE PIPE SUPPORT TABLE THIS SHEET FOR REQUIRED REINFORCING

FOR "H" DIMENSION SEE TABLE THIS SHEET

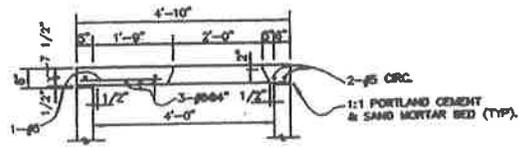
PROVIDE MINIMUM FALL OF 0.1 FOOT DROP INLET TO MAIN CHANNEL

**SECTION  
DROP MANHOLE  
PRECAST CONCRETE MANHOLE**

STANDARD DRAWING	TYPICAL PRECAST CONCRETE DROP MANHOLE	
	SEWER DIVISION	DWG. No. SD-18



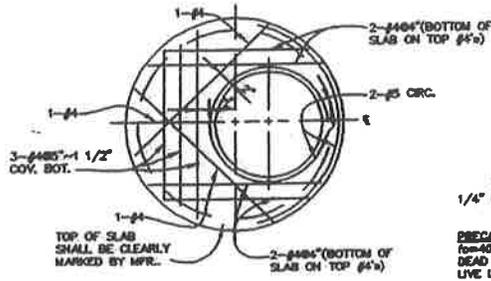
PLAN



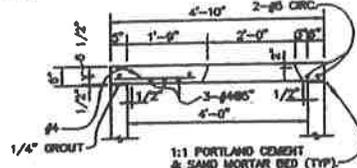
SECTION ON E

**PRECAST SLAB PROPERTIES:**  
 $f_c=4000\text{psi}$ ;  $f_y=60\text{ksi}$ ;  $f_w=20\text{ksi}$   
 DEAD LOAD=SLAB WEIGHT +120psf EARTH  
 LIVE LOAD=HS20-44

PRECAST TOP SLABS FOR 4'-0" I.D. TRAFFIC MANHOLES



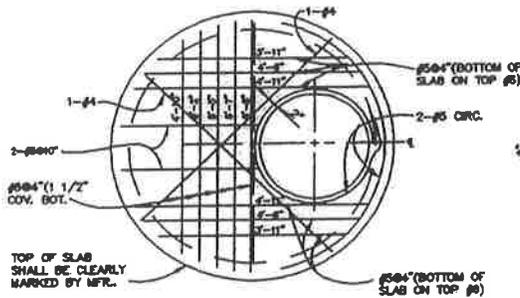
PLAN



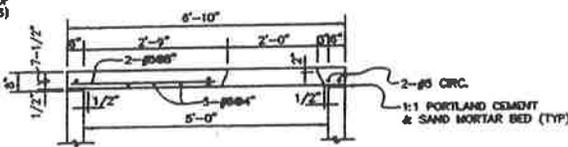
SECTION ON E

**PRECAST SLAB PROPERTIES:**  
 $f_c=4000\text{psi}$ ;  $f_y=60\text{ksi}$ ;  $f_w=20\text{ksi}$   
 DEAD LOAD=SLAB WEIGHT +120psf EARTH  
 LIVE LOAD=200psf

PRECAST TOP SLABS FOR 4'-0" I.D. NON-TRAFFIC MANHOLES



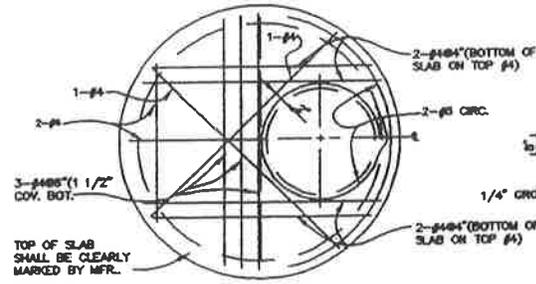
PLAN



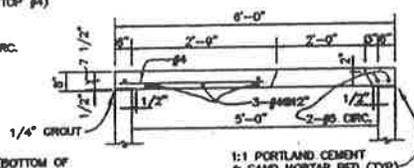
SECTION ON E

**PRECAST SLAB PROPERTIES:**  
 $f_c=4000\text{psi}$ ;  $f_y=60\text{ksi}$ ;  $f_w=20\text{ksi}$   
 DEAD LOAD=SLAB WEIGHT +120psf EARTH  
 LIVE LOAD=HS20-44

PRECAST TOP SLABS FOR 5'-0" I.D. TRAFFIC MANHOLES



PLAN



SECTION ON E

**PRECAST SLAB PROPERTIES:**  
 $f_c=4000\text{psi}$ ;  $f_y=60\text{ksi}$ ;  $f_w=20\text{ksi}$   
 DEAD LOAD=SLAB WEIGHT +120psf EARTH  
 LIVE LOAD=200psf

PRECAST TOP SLABS FOR 5'-0" I.D. NON-TRAFFIC MANHOLES

# PRECAST MANHOLE TOP SLABS

MANHOLE TOP SLABS  
 PRECAST CONCRETE MANHOLE

STANDARD DRAWING

SEWER DIVISION

DWG. No. SD-19

## SECTION FIVE

# SEWAGE FORCE MAINS

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5.0 PURPOSE - The purpose of this section is to give the specifications for the primary materials utilized in the construction of sanitary sewer force mains.

5.1 DESIGN REQUIREMENTS - Sanitary sewer force mains shall be designed so that the minimum velocity of 2.0 fps is developed when the sewage pumps are operating at the design TDH. Minimum depth of 30 inches cover must be provided, and no. 8 solid copper wire shall be laid with nonmetallic pipe.

### 5.2 PIPE MATERIALS

5.2.1 Ductile Iron Pipe, Ductile Iron Fittings and Joints - See Section 3.2.1.

5.2.2 Polyvinyl Chloride Pressure Pipe, Ductile Iron Fittings and Joints

a. Pipe - PVC pipe for sewer force main shall be extruded from Class 12454-B polyvinyl chloride material with a hydrostatic design stress of 2,000 psi for water at 73.4 degrees Fahrenheit, designated as PVC 1120, meeting ASTM Specifications D 1784 for material. Two-inch through 12-inch pipe for sewer force main service shall be SDR-21 for 200 psi allowable working pressure at 73.4 degrees Fahrenheit and a safety factor of 2.0, as specified in ASTM D 2241. The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, burst pressures, flattening, extrusion quality, marking and all other requirements of ASTM D 2241 shall be conformed with in all respects.

b. Fitting - Ductile iron mechanical joint fittings with appropriate adapters may be used with exterior PVC pipe. All such fittings shall be approved by the pipe manufacturer.

c. Joints - Exterior buried PVC pipe shall be jointed with slip-type joints with rubber gaskets. Pipe with bells shall have all parts of the bell, including the gasket groove, made from the same extruded piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. The gasket groove shall be constructed such that gasket rollout will not occur. Rubber gasketing shall conform to ASTM D 3139.

5.2.3 Steel Encasement Pipe - See Section 3.2.3.

5.3 FORCE MAIN CONSTRUCTION - Trench excavation, pipe bedding, laying, jointing, backfilling and road/drive crossings shall comply with Sections 3.4 through 3.10.

5.4 TESTING OF SEWAGE FORCE MAIN - On all projects involving the installation of sewage force mains, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results:

5.4.1 Initial Procedure - Prior to pressure testing the pipe shall be center loaded with backfill to prevent arching and whipping under pressure. Center loading shall be done carefully so that joints will be completely exposed for examination during testing unless conditions warrant complete backfill before testing.

During the general construction period the following pressure testing procedure shall be followed (on sections that can be separately isolated):

After the pipe is assembled in the trench a test of not more than 30 percent above the system's anticipated working pressure shall be applied with either air or water. After 2 consecutive tests have been performed without any failure, the CONTRACTOR at his option and with the ENGINEER'S permission may discontinue

testing until the system is completed. Testing shall then be performed as outlined herein in this Section.

5.4.2 Testing Pressure Pipe for Leakage - The CONTRACTOR will be required to test all pipelines and appurtenances with water. The maximum test pressure, measured at the lowest elevation of the pipeline being tested, shall be the pressure class of the pipe unless a specific test pressure is shown on the Drawings.

When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in 4 hours, the ENGINEER, at his discretion, may accept the line or section as being tested, or he may require the test run the full 24 hours.

At the end of the 24-hour test period, the pressure shall be recorded. If there is a drop in pressure, the CONTRACTOR will be required to pump the section being tested up to initial test pressure and maintain that pressure for 24 hours, measuring the amount of water required to accomplish this. The line will not be accepted until the leakage shall prove to be less than 10 gallons per inch diameter per mile of pipe per 24 hours.

Should there be leakage over the allowable amount, the CONTRACTOR will be required to locate and repair the leaks and retest the section. It is suggested, but not required, that the CONTRACTOR have a geophone (underground listening device) on the job at time of testing. This has proven very helpful in the past in locating leaks.

If the leakage of a section of pipeline being tested is below the allowable amount, but a leak is obvious, in the opinion of the ENGINEER, due to water at the surface of the ground, or by listening, the leak can be heard underground with the geophone, or any other means of determining a leak, the CONTRACTOR will be required to repair those leaks.

The CONTRACTOR shall furnish meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping

equipment which will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.

Inspection of pipe laying shall in no way relieve the CONTRACTOR of the responsibility for passing tests or correcting poor workmanship.

The UTILITY shall furnish a recording gauge and clock used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall remain the property of the UTILITY at conclusion of test.

5.5 CONNECTING FORCE MAIN TO MANHOLE - All sanitary sewer force mains must connect to manholes at the flow channel elevation. The ENGINEER shall show details on his plans indicating the method of connecting force mains to manholes.

5.6 CONCRETE THRUST BLOCKS - Concrete thrust blocks shall be provided at all bends in the force main as shown on Standard Drawings SD-13. The UTILITY reserves the right to increase the size of these thrust blocks, if necessary.

## SEWAGE PUMP STATIONS

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**6.0 PURPOSE** - The purpose of this section is to outline specifications for a sewage pumping station that is to become a part of the Mt. Sterling Sewer System.

### **6.1 DESIGN REQUIREMENTS**

**6.1.1 Minimum Requirements** - Any sewage pump station that is to become part of the Mt. Sterling public sewer system shall be a duplex, submersible type station, with minimum 3-inch size open impeller type centrifugal solids handling pumps, and minimum force main size of 4-inch diameter. The minimum pump capacity shall be 80 gallons per minute to provide a minimum velocity of 2.0 fps in the force main. Small diameter grinder pumps and small diameter force mains are not acceptable, unless ownership, operation and maintenance of such facilities is to remain with the OWNER-DEVELOPER, or subsequent property owner. Minimum property requirements are a 25-foot by 25-foot lot and 12-foot wide access road, both to be dedicated to the UTILITY by a recorded permanent easement.

**6.1.2 Calculations** - Design calculations for sewage pump stations shall include the basis for selection of pump capacity at the design TDH, static head between the pump discharge and the force main discharge, capacity of the wet well, frequency and duration of operation.

**6.2 SCOPE** - The work to be performed under this section of the specifications consists of the furnishing of all labor, materials, equipment and services necessary for furnishing and installing factory built, underground submersible sewage pumping stations complete and in proper operating condition. The location, size, and details of the stations shall be as shown on the plans. The work for the station shall include excavation, placing the concrete base slab, construction of the pump and valve pits, including hatches and covers, connecting the influent sewers to the station, all interior piping, connection of the force main to the station and

all other necessary piping, valves and fittings required.

Other work to be performed under this section includes backfilling, grading, electrical work as shown on the Drawings or specified in this section and acceptance tests.

**6.3 GENERAL** - The underground submersible sewage pumping station shall be furnished with all necessary equipment installed in a precast concrete wet well as shown on the Drawings and in accordance with Drawings SD-14. The principal items of equipment in the station shall include 2 vertical, motor-driven non-clog submersible sewage pumps, necessary gate and check valves, required piping, central control panel with circuit breakers, motor starters, access hatch, and automatic pumping level controllers, vent piping, slide rails, and other required appurtenances and wiring.

**6.4 PUMP AND VALVE PITS** - The pump and valve pits shall be constructed of prefabricated reinforced concrete pipe conforming to the requirements of ASTM C76. The concrete slab cover for the pump pit shall be adequately reinforced to support a live load of 300 pounds per square foot.

**6.5 PUMPS** - The pumps shall be capable of handling unscreened raw sewage at a pumping rate adequate for the total dynamic head and flow rate required for proper operation of the system in which it exists. The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, permanently installed in the wet well. The pump shall be easily removable for inspections or service, requiring no bolts, nuts or other fastenings to be disconnected. For this purpose, there shall be no need for personnel to enter the wet well. Each shall be fitted with a chain of adequate length and strength to permit raising and lowering the pump for inspection and removal. The pump, with its appurtenances

and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 165 feet.

All major parts, such as the stator casing, oil casing, sliding bracket, volute and impeller shall be of gray iron. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed bolts and nuts shall be of stainless steel.

The pumps shall be capable of continuous dry pumping in a totally dry condition without damage to the motor or seals.

**6.6 PUMP MOTORS** - All pump motors shall be vertical, submersible, and rated for continuous duty on 230 or 460 volts, 3-phase, 4-wire electric power.

Pump motors shall be housed in an air-filled, watertight casing and shall have Class "F" insulated winding which shall be moisture resistant. The motor shall be NEMA Design B rated 155 degrees Celsius maximum. Pump motors shall have cooling characteristic suitable to permit continuous operation in a totally nonsubmerged condition.

Motors shall be supplied with heat sensing units attached to motor winding. The heat sensing units shall trip the starter if motor overheats.

The cable entry water seal design shall be such that precludes specific torque requirements to insure a watertight and submersible seal. Epoxies, silicones or other secondary sealing systems shall be used. The cable entry junction box and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign materials gaining access through the pump top.

The pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable.

**6.7 LEVEL CONTROLS** - Liquid level controls shall include mercury switch level sensors in corrosion and shock resistant plastic casing with flexible cord and weight. The level control

system shall include support brackets for suspending a minimum of 4 sensors at proper levels in the wet well, and NEMA 4 water tight junction box as shown on the plans: one for pump turn-on; one for pump turn-off; one for both pumps on and one for alarm. Controls for automatically and manually alternating the pumps shall also be installed.

**6.8 MOTOR CONTROLS** - Motor controls shall consist of a duplex control panel in a NEMA 4 waterproof enclosure, and shall have a dead front with separate removable inside panel to protect electrical equipment. Panel will contain circuit breakers, magnetic starter and Hand-Off-Auto switch for each motor. Duplex panels will include manual and automatic electric alternator.

A high water alarm flashing light shall be supplied in separate NEMA 4 enclosure and mounted at the control box. All motor controls shall include all equipment required by the manufacturer and the UTILITY to insure proper operation of the pumping station.

## **6.9 ELECTRICAL WIRING**

**6.9.1 General** - The pumping station shall be completely wired at the factory, in accordance with the National Electric Code and shall be color coded. The pump power cables shall be one continuous cable, without splices or junction boxes of any type, from the pump to the control panel. All wiring outside the control cabinet shall be in rigid conduit or "Sealtite." All accessory equipment shall be permanently wired with suitable disconnecting means and overload protection. Cord, plug and receptacle type connections will not be acceptable.

**6.9.2 Code Requirements** - All level controls, motor controls, power and control wiring and enclosures shall comply with the NEC and with NFPA 820, regarding hazardous locations.

**6.9.3 Transfer Switch** - The pump station shall have a manual transfer switch and generator receptacle, compatible with the UTILITY'S generator. The station will be run by the UTILITY'S generator for a period of time before acceptance of the station by the UTILITY.

6.9.4 Wiring/Control Drawings - A complete wiring and control diagram, as-constructed, shall be furnished to the UTILITY.

6.10 OUTSIDE ELECTRICAL SERVICE -

Connection of electrical service to the pumping station shall be as indicated on the Drawings and further specified herein.

- a. The service pole shall be fully treated, southern yellow pine roofed 15 degrees one way and gained before treatment.
- b. The weatherproof switch and meter socket shall be fastened to rustproof channels that are banded to the pole with rustproof bands.
- c. The service entrance fitting at the pole shall be cast aluminum with stainless steel screws.
- d. Conduit and conduit fittings shall be heavy, threaded, galvanized steel. Fittings shall have neoprene gaskets for covers. Conduit shall be fastened to the service pole with tow-hole, heavy, galvanized straps with rustproof lag screws - minimum spacing on 5 foot centers.
- e. Control wire extensions shall be made as detailed on the Drawings. Components shall be NEMA 4.
- f. Insulating bushings of the heavy fiber reinforced type shall be employed on all conduit terminations.
- g. All screws and fasteners are to be rustproof, double hot dipped galvanized, Monel metal or stainless steel.
- h. Fuses shall be Bussman "Low-Peak," or approved equal.
- i. A security light shall be installed on the service pole.
- j. At least two 110-volt, single phase, convenience outlets shall be included.
- k. All the electrical work shall be inspected and approved by an electrical inspector. Two copies of the certificates of approval by the Electrical Inspector shall be

mailed to the UTILITY and a label of acceptance must be glued inside the door of the disconnect before final acceptance.

6.11 SEWAGE PIPE, FITTINGS AND VALVES-

All inside piping shall be Class 350 ductile iron pipe, flanged ANSI Class 125 inside and terminating in mechanical joints bells outside. Outside piping shall conform to the requirements set out hereinbefore.

Gate valves shall be resilient seat type. Check valves shall be spring operated, external lever type, bronze fitted. Gate valves shall be provided on the discharge lines and a check valve on the discharge line between pump and gate valve as shown on the plans.

A pressure gauge shall be installed downstream and upstream of the check valve. Coupling adapters shall be Type 912 cast iron as manufactured by Smith-Blair, or approved equal.

A quick-connect force main connection shall be included in or adjacent to the valve vault.

6.12 CONCRETE BASE, PUMP WELL AND

VALVE PIT - Class "A" reinforced concrete shall be provided for the pumping station base slab as shown on the plans. The pump well shall be of precast reinforced concrete pipe of the dimensions as shown on the Drawing, or approved equal. All applicable provisions of Section 7 shall govern the construction of the pump well and valve pit. Valve pit shall have a 1/4-inch aluminum checkered plate covering.

6.13 FACTORY TESTING - The pump manufacturer shall perform inspection tests on each pump before shipment to insure proper operation of the pump and compliance to the customer's purchase order.

6.14 ACCEPTANCE TEST - After installation, the pumping station shall be given a running test of all equipment. During the test, all piping and seals shall be checked to insure no leaks occur at all and controls shall be carefully checked and balanced for proper operation.

The CONTRACTOR shall furnish all necessary tools, materials, equipment and supervision of the tests; however, the OWNER-DEVELOPER will furnish the electrical energy.

Any defects in the equipment or failure to meet the guaranteed requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the UTILITY as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

#### 6.15 TOOLS, SPARE PARTS AND MANUALS -

One complete set of tools required for routine maintenance, together with any special tools required for such purpose, shall be furnished. Tools shall be supplied in a substantial steel tool box.

A complete replacement pump shaft seal assembly, complete with installation instructions and spare volute gasket shall be furnished.

A complete operating and maintenance manual, in duplicate, shall be furnished. A one year's supply of lubricants shall be supplied.

6.16 MANUFACTURER - The pumps shall be as manufactured by Flygt, Myers, or approved equal.

#### 6.17 SITE DEVELOPMENT

6.17.1 Stripping and Topsoiling - Before excavation and grading is commenced for pumping station, the topsoil and sod shall be removed from the areas affected and stockpiled. When final grading is accomplished, the topsoil shall be spread evenly over the excavated areas. Rough grading shall have been carried approximately 6 inches below finished grade and brought back up to grade with topsoil as set out herein.

6.17.2 Site Grading and Fills Around Structures - All materials used for backfill around pumping stations shall be of a quality acceptable to the UTILITY and shall be free from large or frozen lumps, wood and other extraneous material. All spaces excavated and not occupied by footings, foundations, walls or other permanent work shall be refilled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills with terraces around the structures, the fill shall be placed in layers not exceeding 12 inches in depth and shall be kept smooth with an approved type roller and/or compacted to the

satisfaction of the UTILITY. When, in the opinion of the ENGINEER, it is not practical to roll sections of the fill immediately adjacent to buildings or structures, then such sections shall be thoroughly compacted by means of mechanical tamping, hand tamping or puddling as may be required by the ENGINEER. All fills shall be placed so as to load structures symmetrically.

The grading shall be brought to the levels shown on the plans or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than 2 inches in diameter. Rock and/or shale excavation which has been removed may be placed in the fills, but it shall not be closer than 12 inches from finished grade.

6.17.3 Excavation - Excavation shall be accomplished in such places as indicated on the Drawings to the lines, grades and elevations shown, or as directed. The excavation shall be maintained in such a manner so as to be well drained at all times. Temporary drains, or drainage ditches, shall be installed at the CONTRACTOR'S expense to intercept or divert surface water. The CONTRACTOR shall, at his own expense, provide adequate facilities for promptly and continuously removing water from the excavation. Should unstable material be encountered, or if the depth of excavation exceeds 6 feet, the sides of the excavation shall be supported by sheeting, bracing and shoring, or the sides sloped to the angle of repose.

6.17.4 Landscaping - All disturbed areas around the pump stations shall be graded, fertilized and seeded as required in Section 8 and/or as directed by the UTILITY.

6.17.5 Fence - A 7-foot high chain link fence with gate shall surround the station. Three barbwire strands shall top the fencing fabric. The gate shall be a minimum of 12 feet wide. The ENGINEER'S plans for the station shall show a detail of the fence and gate.

6.17.6 Clean Up - The CONTRACTOR shall remove all objectionable matter resulting from his operations.

6.18 ACCESS ROAD - An access road to the station shall be constructed from the main thoroughfare street or road. This road shall be made of crushed stone unless otherwise requested by the UTILITY. The access road shall be on a permanent easement dedicated to the UTILITY.

6.19 WARRANTY - The complete pump station shall have an unconditional one year warranty on all parts and labor. The sewage pumps shall have a 5-year, prorated manufacturer's warranty.

6.20 UTILITIES - A one inch city water line is to be installed at the property for clean-up purposes. Cost of installation shall be borne by the OWNER-DEVELOPER.

## SECTION SEVEN

# CONCRETE

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**7.0 PURPOSE** - The purpose of this section is to give specifications for concrete utilized in the construction of water mains, sanitary sewers, and sewage pump stations and other related items in the construction of public facilities.

**7.1 CEMENT CONCRETE** - Cement concrete shall consist of a mixture of Portland cement, fine aggregate, coarse aggregate, with or without air entrainment as required, combined in the proportions and mixed to the consistency specified; and shall be deposited in such forms and to such dimensions as indicated on the plans or as specified by the ENGINEER.

**7.1.1 General** - All cement concrete shall be in accordance with the Kentucky Department of Highways Specifications and latest ACI for the various classes and types as specified therein. Unless otherwise directed by the UTILITY, the classes or types of concrete to be used in various types of construction shall be as set forth below.

- a. Class "A" - 4000 psi, 28-day strength as per ACI 301 for all curb and gutter, sidewalks, paved ditches, retaining walls, drainage structures, pipe headwalls, sewage lift stations base slab and other miscellaneous structures.
- b. Class "B" - 3500 psi, 28-day strength as per ACI 301, Section 601, except use cement factor of 1.25 for encasement or cradle of sanitary sewer pipe structures.

**7.1.2 Cement** - Cement, unless otherwise specified, shall conform to ASTM C150 for Type I, Portland cement with 3 to 6 percent air by volume added to the mix or ASTM C175 for Type IA, Air Entraining Portland cement.

**7.1.3 Fine Aggregate** - See Section 7.2.1.

**7.1.4 Coarse Aggregate** - See Section 7.2.2.

**7.1.5 Water** - Water shall be kept free from injurious amounts of oil, acid, alkali, organic matter or other such deleterious substances. A

rule of thumb to follow is that when the water is fit to drink, it is suitable for concrete.

**7.1.6 Admixtures** - Admixtures for adding air to concrete made with Type I Portland cement, must meet the requirements of ASTM C226.

**7.1.7 Consistence of Concrete** - The consistency of the concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement, but without permitting the materials to segregate or excess water to collect on the surface. When the specified slump is 3 inches or less, the tolerance shall be plus or minus 1/2-inch. When the specified slump is greater than 3 inches, the tolerance shall be plus or minus 1 inch.

**7.1.8 Transporting and/or Conveying** - Concrete shall be conveyed from the mixer to the place of final deposit immediately after mixing by methods which will prevent the separation or loss of material.

Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery and without segregation of the material.

Non-agitating type trucks shall not be used to haul ready mixed concrete under any circumstances. With respect to the trucks used to deliver ready mixed concrete, the number of revolutions of the drum at mixing speed, the number of revolutions of the drum at agitation speed and other such details shall conform to ASTM C94. In all such cases, however, the concrete shall be delivered to the job site and discharged 1-1/2 hours and before the drum has been revolved 300 times, whichever comes first, after the mixing water has been added to the other ingredients. In hot weather or under other conditions contributing to quick stiffening of the concrete, a time less than 1-1/2 hours maybe specified by the UTILITY.

7.1.9 Placing Concrete - Concrete shall be delivered to its position of placement, within the required time for delivery after mixing and within the required time interval between delivery of batches, as specified hereinbefore or by the UTILITY for the method of mixing and handling employed.

Water shall be removed from all foundation excavation or formwork before the concrete is deposited. The method and manner of placing shall be such as to avoid the possibility of segregation or separation of aggregates or the displacement of the reinforcement. Placing of the concrete shall be such as to entirely fill the form, but not to budge or distort the forms or their alignment. Special care shall be taken to fill each part of the forms by depositing concrete as near to its final position as possible, to work the coarser aggregate back from the face and to force the concrete under and around the reinforcing bars without displacing them.

The concrete shall not be allowed to drop freely more than 3 or 4 feet. In thin sections, drop chutes of rubber, canvas or metal shall be used. Drop chutes shall be provided in several lengths or shall be in sections which can be hooked together so that the length can be adjusted as concreting progresses.

When vibrating is required, it shall be done by methods approved by the UTILITY and with equipment approved by the UTILITY.

7.1.10 Curing - All concrete shall be cured for a period of not less than 7 days after pouring. The method used to provide curing shall be approved by the UTILITY. Membrane curing, plastic sheet curing, and wetted burlap curing will be considered satisfactory.

If at anytime during the 7-day curing period, the air temperature is 40 degrees Fahrenheit or less, concrete shall be insulated and/or heated as directed by the UTILITY to aid curing and to prevent freezing. Protective covering which will protect the surface of freshly placed concrete from rain shall be readily available at the site of the work. Concrete damaged as a result of failure on the part of the CONTRACTOR to adequately protect the concrete from rain for freezing shall be removed and replaced at the expense of the CONTRACTOR as directed by the UTILITY.

## 7.2 AGGREGATE FOR PORTLAND CEMENT CONCRETE

7.2.1 Fine Aggregate - Fine aggregate shall consist of natural sand having clean uncoated grains, free from injurious amounts of clay, flaky material, lignite, organic material and other such foreign substances and shall meet the requirements of ASTM C33.

Fine aggregate shall meet the gradation requirements as set out in Table 7-1.

7.2.2 Coarse Aggregate - Coarse aggregate shall be crushed stone, gravel or slag having clean, hard, uncoated particles. Crushed stone is preferred for coarse aggregate; gravel or slag shall not be used unless written approval is obtained from the UTILITY. It shall be free from injurious amounts of soft, friable, thin, elongated or laminated pieces, shall meet the requirements of ASTM C33 and the gradation requirements as listed in Table 7-1.

**TABLE 7-1  
AGGREGATE GRADATIONS**

<i>Aggregate</i>		<i>Total Per Cent Passing Square Sieves</i>											
Std. Size	Nominal Size	2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#16	#50	#100
357	2"-#4	100	95-100		35-70		10-30		0-5				
467	1-1/2"-#4		100	95-100		35-70		10-30	0-5				
57	1"-#4			100	95-100		25-60		0-10	0-5			
68	3/4"-#8				100	90-100		30-65	5-25	0-10	0-5		
Sand								100	85-100		40-80	5-25	0-5

NOTE: Use Size No. 357 crushed stone coarse aggregate for Portland cement concrete bases and pavements. Gravel aggregate for same may be Size No. 357 or Size No. 467.

Use Size No. 57 coarse aggregate for Class "A" concrete.

Use Size No. 357 or No. 57 coarse aggregate for Class "B" concrete.

## SEEDING AND SODDING

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8.0 PURPOSE - The purpose of this section is to outline the minimum requirements for proper seeding, sodding, and landscaping in areas of water and sewer utility construction.

### 8.1 SEEDING, SODDING AND

LANDSCAPING - Shall be accomplished as described hereinafter. Unless otherwise specified by the UTILITY, all graded areas shall be left smooth and thickly sown with a mixture of grasses at a rate of not less than 87 pounds per acre. Unless otherwise specified, the mixture shall consist of 60 percent Kentucky Fescue #31, 30 percent creeping red fescue, and 10 percent white clover. When the final grading has been completed, the entire area to be seeded shall be fertilized with number 12-12-12 fertilizer at a rate of 1,000 pounds per acre. Agriculture limestone shall be added at a rate of 4.4 tons per acre or as specified by the ENGINEER. After the fertilizer and agricultural limestone has been distributed, the CONTRACTOR shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be broadcast either by hand or by approved sowing equipment at the rate specified. After the seed has been distributed, the CONTRACTOR shall then lightly cover the seed by use of a drag or

other approved device. All seed shall be certified. The seeded area shall then be covered with straw to a depth of approximately 1-1/2 inches. Any necessary reseeding or repairing shall be accomplished by the CONTRACTOR prior to final acceptance. If the construction work is brought to completion when, in the opinion of the ENGINEER, the season is not favorable for the seeding of the grounds, then the CONTRACTOR shall delay this item of the work until the proper season for such seeding as directed by the ENGINEER.

Sodding will not be required unless specifically set forth by the UTILITY. When sodding is required, it shall be at least 60 percent good quality Kentucky Bluegrass, strongly rooted, and free of pernicious weeds and shall be so laid that no voids occur between strips. Weed roots shall be removed as the sod is laid, and the finished surface shall be true to grade even and equally firm at all points. Well screened topsoil shall be lightly sprinkled over the sodded areas and shall be raked to insure sealing the sod joints. The sodded areas shall be thoroughly watered.